

PROJECT MANAGEMENT **HANDBOOK**

A Guide to Managing Successful Projects



Secretary of Public Safety

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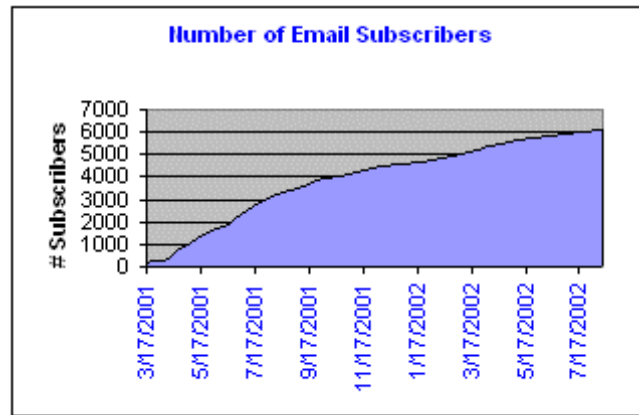
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1.0 Define the Work

Hitting aggressive deadlines puts pressure on the Project Manager to start the project as soon as possible. However, before the project work begins, there needs to be time spent in up-front planning to make sure that the work is properly understood and agreed to. This is not wasted time or 'overhead' time. This is the time the Project Manager spends ensuring that the project team and the customer have common perceptions of what the project is going to deliver, when it will be complete, what it will cost, who will do the work and how the work will be done.



At the end of a difficult project, the benefits of planning might be obvious. But, the benefits should be known ahead of time as well. At a high-level, the benefits include:

- Understanding and gaining agreement on project objectives, deliverables, scope, risk, cost, approach, etc. (From the **Project Definition**.)
- Determining if the original business case is still valid. For instance, a project that requires 10,000 effort hours might make business sense. If the planning process results in a 20,000-hour estimate, the project may not make sense any more.
- Making sure the resources you need are available when you need them.
- Providing a high-level baseline, from which progress can be compared.
- Working with your customer ahead of time on the processes used to manage the project.

It should make sense that small projects need a shorter planning cycle, and larger projects need a longer planning cycle. The effort required to plan the project is based on the level of detail that needs to be understood and documented. The time duration for defining the work depends on how long it will take to find the necessary information, and how long it will take to gain agreement from the customer. At times, the Project Manager can get frustrated because of the difficulty gaining agreement with the customer on scope, timeline and cost. But that is exactly the reason this work is done ahead of time. Think of the problems you will encounter trying to gain agreement with the customer on scope or cost when the deliverables are actually being produced.

Before a project starts, a number of factors need to be in place. For smaller projects, many of these conditions are met informally or implicitly. However, the larger a project gets, the more important it is that these criteria be met formally and explicitly.

- Business approval to plan - Normally, implicit approval is assumed to have occurred for the project to even be surfaced to begin with. However, if the project did not have a business case prepared and if it did not go through a prioritization process, then explicit approval should be sought for project planning.
- Project Defined - This is documented in the **Project Definition**, which contains objectives, scope, assumptions, deliverables, budget, etc. (For medium or small projects, this might be the **Abbreviated Project Definition** or a **Service Request**.)
- Business approval to begin project - Signified through a signed, approved **Project Definition**. The Sponsor must sign the document to ensure agreement.
- **Project Workplan** - A workplan must be prepared and used to manage the effort. This includes checkpoints when the project can be evaluated to ensure that it is appropriate to continue.
- **Project Management Procedures** - Procedures must be in place for how the project will manage issues, communication, risks, quality, scope, etc. This is especially true for large projects, and less important as a project gets smaller.
- **Project Team** - You must have the right people to staff and execute the project. Sometimes valid, approved projects must be delayed because people with the right skills are not available.

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Although it may be obvious, perhaps the place to start is a general discussion on what a project is. This will make it clearer when project management techniques are appropriate. For a general discussion, see 1.0.1 What is a Project? When you have a sense for what a project is, let's also make sure we understand what a Project Manager is - 1.0.2 The Role of a Project Manager.

1.1 Define the Work / Process

1.2 Define the Work / Techniques

1.3 Define the Work / Deliverables

1.4 Define the Work / Additional 'Build Workplan' Activities (Not Applicable)

1.0.1 What is a Project?

Before you can be a good 'Project Manager' and apply good 'project management' techniques, you must first be sure that the work you are undertaking is, in fact, a project. Some people say that all work is a project. I don't think that is accurate. There are really two kinds of work - routine work (support) and project work.

Routine work covers the normal things you do as an ongoing part of your job. In many organizations, this is called support work. For IT development people, support work consists of answering questions, going to regularly scheduled meetings, fixing problems in the production systems, etc. For sales people, this could be making daily sales calls, moving contracts through an approval process, updating call logs, etc. For an accounts receivable clerk this could be checking reports, balancing accounts, posting journal entries, closing out the system, etc. The key criteria is that the work is an ongoing, and routine, part of your job. This is the work you do today, tomorrow and a month from now.

On the other hand, projects are not routine. The biggest difference is that projects, by their definition, have a defined start and end-date. There is a point in time when the work did not exist (before the project), when it does exist (the project), and when it does not exist again (after the project). This is the key determinant of whether a piece of work is a project. However, other characteristics of a project include a defined scope, finite budget, specific end result (or deliverables) and assigned resources. Another characteristic of a project is that the work is unique. Even if a project is similar to another one, it is not exactly the same because circumstances change and because things are always different when you are dealing with people.

That being said, now you must get practical. In theory, projects can be one hour, 100 hours or 100,000 hours. So, you must recognize that, although the creation of a small deliverable is a project, it does not need the structure and discipline of a much larger project. For a one-hour project, you 'just do it'. Any planning analysis and design is all done in your head. For a twenty hour project, you *mostly* 'just do it'. However, now you may need to plan a little bit, maybe communicate a little bit, maybe deal with problems a little bit. A one hundred hour project probably has too much work to plan and manage it all in your head. For instance, you need to start defining the work and building a simple workplan. A five thousand-hour project needs full project management discipline. On the other extreme, a 10,000-hour project probably has too much to get our heads around it all. Now you start to break the larger project up into smaller, but related, projects to get the entire piece of work done.

1.0.2 The Role of a Project Manager

A new employee in the company mailroom noticed an older man sitting in the corner, sorting mail, weighing packages, adding postage and doing other simple jobs. He asked his supervisor who the man was.

"That's Joe." the supervisor said. "He has been with the company for 35 years and is getting close to retirement."

"Really." the new employee replied. "And he's been in the mailroom the whole time?"

"No, he left a number of years ago. But he asked for a transfer back - after spending several years as a Project Manager."

On the surface, the role of a Project Manager should be easy to describe. In fact, from a textbook perspective it probably is. But the challenge to understanding roles and responsibilities is that they are different from company to company. So, although this web page will provide an overall perspective of the role, you still need to determine what the role of a Project Manager is *at your company, or in your organization.*

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General Definition

In general, the Project Manager is responsible for the overall success of the project. Other job titles might include a Project Coordinator, or a Team Leader, but if your company calls you a Project Manager, the chances are that they expect you to be responsible for ensuring the success of the project.

What does it take for the project to be a success? If you follow the SPS Project Management Process, or a similar approach, you first must define the project and build the workplan. So, this is where the Project Manager's responsibilities start. If the project begins and you find out later that you are not clear on scope, the Project Manager is the one who will look bad. If your project is executing a poor workplan, the Project Manager will be accountable. Defining the project means to understand and gain agreement on the overall objectives, scope, risk, approach, budget, etc. It also includes defining, or adopting, the specific project management procedures that will be used to manage the project.

This does not mean that the Project Manager must do all this work themselves. There may be an entire team of people helping to create the Project Definition and workplan. However, if something does not go right, the Project Manager is responsible.

Process Responsibilities

Once the project starts, the Project Manager must successfully manage and control the work, including:

- Identifying, tracking managing and resolving project issues.
- Proactively disseminating project information to all stakeholders.
- Identifying, managing and mitigating project risk
- Ensuring that the solution is of acceptable quality
- Proactively managing scope to ensure that only what was agreed to is delivered, unless changes are approved through scope management.
- Defining and collecting metrics to give a sense for how the project is progressing and whether the deliverables produced are acceptable.
- Managing the overall workplan to ensure work is assigned and completed on time and within budget.

Again, this does not mean that the Project Manager physically does all of this, but they must make sure it happens. If the project has problems, or scope creep, or faces risks, or is not setting expectations correctly, then the Project Manager is the person held accountable. If you browse this website, you will understand the specific process responsibilities of the Project Manager.

To manage the project management processes, a person should be well organized, have great follow-up skills, be process oriented, be able to multi-task, have a logical thought process, be able to determine root causes, have good analytical ability, be a good estimator and budget manager, and have good self-discipline.

People Responsibilities

In addition to process skills, a Project Manager must have good people management abilities. This includes:

- General management skills needed to establish processes and make sure that people follow them.
- Leadership skills to get the team to willingly follow your direction. Leadership is about communicating a vision and getting the team to accept it and strive to get there with you.
- Setting reasonable, challenging and clear expectation of people, and holding them accountable for meeting the expectations.
- The larger your team and the longer the project, the more important it is to have good team-building skills, so that the people work together well, and feel motivated to work hard for the sake of the project and their other team members.
- Proactive verbal and written communicator skills, including good, active listening skills.
- Able to give good quality performance feedback to team members

Again, you are responsible for the success of the project. If the team has poor morale and is missing deadlines, you need to try to resolve it. If team members don't understand exactly what they need to do and when it is due, then you are responsible.

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The Role of a Project Manager: Multiple Roles

Depending on the size and complexity of the project, the Project Manager may take on additional responsibilities in addition to managing the work. For instance, the Project Manager may assist with gathering business requirements. Or they may help design a DBMS, or they may write some of the project documentation. It is a good idea, though, to think about the project management as a particular role, even though the person who is the Project Manager might be working in other roles as well.

For instance, a company might say that a typical Project Manager might manage the project for 45%, perform business analysis for 25%, work on design for 15% and write documentation for 15%. However, that does not mean that one of the responsibilities of a Project Manager role is to spend 15% of their time on design. Instead, it just means that the projects are not large enough to need a full-time Project Manager. The Project Manager spends the rest of their time in other project roles such as Business Analyst, Designer and Technical Writer. The project requires the Project Manager to fill multiple roles, each of which requires a certain level of skill and responsibility.

Responsibilities in a Matrix Organization

The most prevalent organizational structure today is some form of matrix organization (See 1.3.4 Define Work / Project Organizations). The matrix organization usually allows the most efficient use of people resources for a company. However, one of the challenges of the matrix organization is that the team members are assigned to the project for work (full time or part time), but the resources report to someone else from a people management standpoint. This can mean that it is harder to get the resources to do the things you need to have done, and there is sometimes a sense that team members would rather do what their functional managers request, rather than what the Project Manager needs. In this type of a structure, there are still a number of proactive things you can do.

- Although the team does not report to you functionally, their work on the project should still be input into their overall performance review. So, you can try to hold people accountable by making sure they understand that you will be providing performance feedback into their review. This should also be reiterated by and agreed to by the functional managers. You may or may not have the ability to make this happen in your organization. You can also discuss project performance with the functional managers. If people are not meeting their deadlines, then perhaps it is a combination of your feedback, as well as the feedback from the functional manager that is needed. Of course, you must also make an evaluation as to why people are not meeting deadlines. If it is because of a lack of skills, this should be addressed through training or replacement resources. If it is because they don't fully understand the expectations you have, then you may have some changes to make as well.
- From a process side, there are project management techniques and processes that should be utilized. First of all, if the availability and performance of the team is in doubt, you should raise this early as a project risk. As part of risk management, you need to put a proactive plan in place to make sure that this risk is addressed. When people miss their deadlines, you may need to raise an issue, and perform issues management. During issues management, you again look for the cause of the problem. Are they missing deadlines because they are being pulled from your project to do other work, such as application support? If so, this may need to be addressed one way. Are they missing dates because the initial estimates were too low? If so, then that needs to be addressed another way. Are they missing dates because of performance problems? Again, that needs to be addressed a third way, with the help of the functional managers. In general, since you don't have authority over the resources, you need to get help from people who do have that authority.
- In addition, make sure your team members are communicating proactively with you. In many cases, it's not the fact that people miss their deadlines that gets us frustrated. It's that they never tell us or give us warning. If a team member has a deliverable due at the end of the week, but then they get pulled into a three-day resolution of a production problem, they need to let you know, so that you can take any appropriate actions you need to do. If they just miss the Friday date, then they are not managing expectations, as they should. By the same token, you need to communicate proactively as well. Communicate well with your team and make sure they understand dates and expectations. Also communicate proactively with the functional managers and make sure they know when there are resource sharing issues or people performance issues.

In summary, matrix management involves a complex and delicate balancing act between Project Managers and people managers. At the same time that you struggle to achieve your results from people that may not work for you full-time, you also may be a Project Manager with additional non-project responsibilities as well. The Project Manager always has limited people management authority in these situations. And yet it is possible to complete your projects successfully. There are many project management processes and techniques that can help. Utilize them to raise risks and issues early and often. Also make sure you

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utilize the project sponsor. After all, it is their project. They can help you generate the urgency and focus, and they can also have an impact on the functional managers to make sure that you, and their project, are successful.

The Role of a Project Manager: Accountability, but not Responsibility

In some organizations, the Project Manager is accountable for the success of the project, but does not have the right level of responsibility. Managing the team in a matrix organization is an example of that. You are managing a project-utilizing people that you do not have direct management responsibility for. In other cases, you may find that your ability to resolve issues is hampered because you are not high enough in the organization to make issues resolution stick. In other instances, you find that your ability to be innovative and flexible is constrained by organizational policies and inertia.

All of these cases can be cause for frustration. One way to deal with this is to define roles and responsibilities as a part of the Project Definition. This can help set and manage expectations. For instance, if you have no budget or expense approval authority, then note that up front, along with a process for expense approval. That way, if problems do arise later, everyone knows what the process is for approving expenses. For most Project Managers, the frustration level is not caused so much by a lack of power as much as it is caused by ambiguity. If the Project Manager does not have the authority, it is important to know who does, and what process is needed to gain action.

1.1 Define the Work / Process

All projects should spend time up-front in a definition step. For small projects, there is a small amount of information needed and therefore the planning process is short. As the projects become bigger and bigger, the need to fully understand what is being requested is more important and gaining agreement on what is to be delivered is harder to define. Therefore, more time needs to be spent planning the work. The following three pages lay out processes for defining the work.

1.1.1 Define the Work / Process / Small Projects

The Service Request Process

In a small project, there is usually not a lot of effort associated with formally defining the work to be done. The **Service Request** document is fairly small and simple. However, the process for assigning the work is different. When the work definition for a larger project is completed, the project is usually ready to begin. However, for smaller efforts, there may be many more **Service Requests** than can actually be worked on at any given time. Therefore, a process needs to be established for gathering **Service Requests** and assigning them to team members based on customer priorities. Since there will likely be many **Service Requests**, it is important to have some way to keep track of them, and a way to ensure that the higher priority requests are being worked on. The following Service Request Process can be used.

1. The customer, with the help of the Project Manager if necessary, completes a simple **Service Request** form. Even though the work may be small, the **Service Request** serves as the formal document describing the work to be done, and contains the appropriate customer approvals.
2. The Project Manager reviews the **Service Request** to ensure that the work is understood. The Project Manager asks questions of the customer, if necessary, to clarify what is being requested. The Project Manager must also understand the criticality of the request and whether any prerequisite work needs to be completed first.
3. If the Project Manager understands the work well enough, they provide a high-level estimate of the effort hours and duration. Otherwise, they assign to a team member. If no one on the team can create a high-level estimate, then the estimation process must itself be placed on the backlog. The customer must decide if the effort required gathering information to make the estimate is of a high enough priority that they are willing to work on it rather than other **Service Requests**. This high-level estimate is used for prioritization purposes only. When the work is actually assigned, a more detailed estimate can be prepared, if necessary.
4. The Project Manager evaluates the request against the available capacity and skill sets on the team to determine if the work can be started immediately. If the required resources are not available, negotiation may need to occur on the start date, number of hours per week, etc. If the request is of lower priority than work currently in progress, the **Service Request** is placed on a backlog list. The backlog contains all work that has been requested, estimated and prioritized, but is not assigned to begin yet.
5. The Project Manager and customer review the backlog on a regular basis. When the priority of a **Service Request** is high enough and the right resources are available, the work can be assigned to begin. If a **Service Request** on the

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backlog is more critical than work that is in-progress, the previously assigned work is placed on-hold, put back on the backlog, or used as filler while the new request is begun.

6. When the work is assigned to begin, the person(s) doing the work should revalidate that the information on the **Service Request** is correct, and that the estimates are accurate. If not, then the new information should be documented and discussed immediately to see if it will have an impact on the priority.
7. Once the work begins, it is managed through the Manage the Work processes.
8. (**Project Management Procedures** are not set up for individual small projects. Instead, generic procedures are established to govern all the work performed through **Service Requests**. The processes are spelled out in the '**Project Management Procedures**' in subsequent steps.)

1.1.2 Define the Work / Process / Medium Projects

It becomes very difficult to be successful on a medium sized project without a formal, documented **Project Definition**. However, it is usually straightforward to uncover the information needed.

1. Look for all the information that may already be applicable for this project. This includes any previous project deliverables, memos, emails, etc. In many cases, before the project begins, the customer must perform some type of high-level cost/benefit analysis or value proposition. All of this information should be gathered as a starting point for understanding the work to be done.
2. Work with your manager and the Project Sponsor to understand what the approval process will be. For instance, does the sponsor want to approve the definition before other stakeholders, or does the sponsor want to have the final approval? Determine who actually has to approve the document versus those that should just receive a final copy.
3. Meet with the appropriate stakeholders (managers, customers, interested parties) and try to understand their perceptions of the work being requested. Make sure that you are familiar with the information that is required for your **Abbreviated Project Definition** deliverable, so that you can gain an understanding of as much of the information as possible.
4. Create your first draft of the **Abbreviated Project Definition**. Write the content for the benefit of the reader, not for the benefit of the Project Manager.
5. A draft of the **Project Workplan** should be started, given as much information as is known at this time. Information from the workplan is used as input into the **Abbreviated Project Definition**, and information from the **Abbreviated Project Definition** is used to help build the workplan.
6. Document the **Project Management Procedures** for this project. It is important to document them ahead of time and get buy-in from management, customers and stakeholders. For instance, it is much easier to resolve a scope change request by following an approved procedure rather than having to invent the procedure and resolve the scope change at the same time.
7. Circulate the **Abbreviated Project Definition** and **Project Management Procedures** in draft form to gather feedback and build consensus. The first drafts may go to a small group of interested parties. The **Project Workplan** does not normally need to be circulated unless there is a specific request to look at it.
8. Update the documents based on accumulated feedback.
9. Optional: Circulate the revised documents to a larger group of interested parties for one more round of feedback. Update the documents again based on this feedback.
10. Start the approval process, as defined in the initial discussion above. (See the techniques section for information on how to circulate the document and options for signifying approval.)
11. After the approval process is complete, circulate copies of the approved **Abbreviated Project Definition** and **Project Management Procedures** to all interested stakeholders.
12. The project is now ready to officially begin.

1.1.3 Define the Work / Process / Large Projects

The Discovery Project

In general, the larger a project is, the more time it takes to put together the **Project Definition**. Without the proper structure, there is a tendency for the definition work to become very lengthy and unfocused. Defining the work for large projects takes enough time that it should be structured as a project itself. This is the purpose of defining a separate Discovery Project.

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This should make sense. If the project is ultimately going to take 50,000 effort hours, it may take a number of months to get the **Project Definition** documented and approved. In these cases, a distinct project is established to define the work, and make sure that there is a common understanding of what will be accomplished. The final deliverable for a Discovery Project is a completed **Project Definition**, **Project Management Procedures** and **Project Workplan** for the subsequent large project. For the most part, all other deliverables will be produced as a part of the next project.

1. Estimate how much effort it will take to complete the **Project Definition**. (Don't necessarily estimate duration, since there may be a long time required for the approval process. This time is not very labor intensive.) Based on the effort required, categorize the work to define the project as small / medium / large using the criteria described earlier. This is the size of the Discovery Project.
2. For a small Discovery Project, a service request can be created, but it is not required. For this size of effort, just continue to do the definition work, as defined in the 1.1.2 Define the Work / Medium project, except **create the full Project Definition** instead of the abbreviated deliverable.
3. For a medium Discovery Project, follow the SPS Project Management Process for a medium project.
 - o The Discovery Project should have an **Abbreviated Project Definition** and **Project Workplan**, and be managed just like any other medium size project, including managing issues, scope, risk, etc. (A **Project Management Procedures** document does not need to be created for the Discovery Project itself.)
 - o When the Discovery Project is complete, the **Project Definition**, **Project Management Procedures** and **Project Workplan** for the subsequent project should be created. The approval process for these documents should be a part of the Discovery Project.
 - o Assuming that the **Project Definition** has been approved, the subsequent project can start at any time. However, Steps '1.0 Define the Work' and '2.0 Build the Workplan' will already be completed. The project management process for this subsequent project can begin in Step '3.0 - Manage the Workplan'.
4. If the size of your Discovery Project is, in fact, a large project, your project is way too big to be successful. Look for ways to break the work into smaller pieces, each of which should be managed as separate, but related, projects.

2.0 Build the Workplan

The **Project Workplan** is created along with the appropriate **Project Definition** deliverable from Step 1.0. It may seem obvious, but the workplan is a vital tool to ensure that the project team knows what they need to do. Many people are uncomfortable creating a workplan. Usually this is because the project has not been well defined. How can a decent workplan be built if the Project Manager is not really sure of what the project will deliver?

2.1 Build the Workplan / Process

2.2 Build the Workplan / Techniques

2.3 Build the Workplan / Deliverables

2.4 Build the Workplan / Additional 'Build Workplan' Activities (contains sample workplan activities for all steps)

2.1 Build the Workplan / Process

The section describes the process for building a workplan. The workplan for small projects can be built without a lot of formality. In general, the Work Breakdown Structure (WBS) technique can be used for both medium and large projects.

Small Projects

Usually there is not a formal process used to build a workplan for a small project. The projects are of the size where it is easy to mentally lay out the steps that need to be performed and the order the steps need to be performed. There are probably only one or two people involved, so it is not hard to figure out who does what. Regardless of the simplicity of the project, the final workplan should be documented. For a small project, you can use a project management package like MS Project, or you can

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use a spreadsheet, or a piece of paper. The point is to sit down, with other team members if appropriate, and lay out the work to be performed. This exercise will give you the estimates on effort, cost and cycle time that is needed for the **Service Request**.

Medium and Large Projects

At the smaller end of these projects, there may be an ability to use the same techniques as for the small projects. However, the larger the project, the harder this process becomes. In the techniques section of this step, there is information on how to build work plans from previous projects. For the purpose of this section, the assumption is that you have to build the workplan from scratch. The best way to do this is through the Work Breakdown Structure (WBS). The general process is as follows.

1. Review the **Project Definition** to ensure an understanding of what is to be produced, the overall timeframe, available staffing, etc. The **Project Definition** may not be complete, but it needs to be in decent first form so that the draft workplan can be built. For a larger project, the Project Definition should also contain the project approach, which provides a high-level description of how the project will be completed. For more information on how to put together the high-level project approach, see 2.1.3 Build the Workplan / Approach. All of this information should be on hand when you start to put together the Work Breakdown Structure.

Create a Work Breakdown Structure

2. First determine the large chunks of work that must be completed for the entire project to be completed. At this point, it is not important how the project is broken down into smaller pieces. For instance, a traditional breakdown might be 'planning/analysis/design/construct/test/implement', which lays out the project in a high-level timeline. The breakdown could also be by deliverable - for instance 'online application/data warehouse/data marts/user query tools'. It could also be by some functional breakout such as 'extract data/load data/report on information'. Break down the work into whatever structure makes sense for your project. The point of the Work Breakdown Structure is to capture all the elements of work. Sequencing is not important at this time. It is important to calculate an estimating threshold so that you know how small to break the work down. See 2.1.2 Build the Workplan / Estimating Threshold for more information.
3. After you finish your initial breakdown of the work, do a quick estimate to determine whether any of the pieces require a larger effort than an estimating threshold. (Some help on estimating is found at 2.1.1 Estimating Process and 2.2.1 Estimating Techniques.) Pieces of work that are greater than the estimating threshold should be broken down into smaller pieces. (This next level breakdown can also apply to work that is already less than the threshold). In other words, describe the steps that must be done to complete each of the work units. When the process is complete, again estimate whether any of the second level activities are greater than the estimating threshold. If so, then they do not need to be broken down further.
4. Continue to break down each step as above, until all of the work is represented as granularly as necessary, with no activities of more than the estimating threshold.
5. You have already done a high-level estimate to determine if the activity is greater than the estimating threshold. When the Work Breakdown Structure is complete, you need to review all the detailed activities and assign initial estimates of effort hours to all of them. Again, you can use estimating techniques (2.1.1 Estimating Process and 2.2.1 Estimating Techniques.). For instance, you may determine, by expert opinion, that a certain activity is 70 effort hours. Then you can use an analogy technique to determine that other activities that are about the same size will also take 70 hours to complete.

For additional information on building a Work Breakdown Structure, see 2.1.6 Build the Workplan / Work Breakdown Structure.

Create a Network Diagram

6. When the Work Breakdown Structure is complete you will have a number of activities, some of which are broken down into smaller sub-activities. Activities that are further broken down into smaller activities are called summary activities. The first step in converting the Work Breakdown Structure into a network diagram is to look at all the detail activities (not the summary activities) and sequence them in a rough chronological order. Remember to include all the

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activities that are not broken down further, regardless of what level they are at in the WBS. In this step, you determine what activities need to be done first, second, third, etc.

7. When you have a rough sequence established, go through the work again. At this time look for the relationships and dependencies between the activities. Note whether one activity cannot start until another activity is finished. (Most activities will have this type of finish to start relationship. However, there are four types of relationships possible between two activities. See 2.1.4 Precedence Relationships for more details.) In many cases, two or more activities may need to be completed before another one can start. As a part of this effort, you will see what activities depend on other activities. You will also find what work can be done in parallel with other work. This step is very important and is the key to having a solid workplan to start the project.
8. If you have not been entering the activities into a project management software tool, you should do so now. (The larger the project, the more critical it is that you use an automated tool to help build the workplan.) Although the activities can be placed in any order when entering them into the tool, it is easier to understand if you enter the activities in chronological order. As you enter the activities, you can also enter the dependencies, since the prior activities should have already been entered first. If you do not enter the activities in chronological order, then you will need to put activities in first, and then specify the dependencies. For each activity entered, you should also include the estimated work effort.
9. Enter any date constraints. Constraints are events that are outside of the control of the project team and must be managed around. For instance, a deliverable may need to be completed before the Board of Directors meeting on a certain date. Or, you may need to place an order with a vendor by a certain date.

Assign Resources

10. So far you have built the plan based on always having the resources you need at the right time. Obviously, that is never the case. Now, assign resources to the work activities. If you have specific resources allocated to your project, you can assign them directly to the appropriate activities. If you do not have all your resources assigned, this allocation will need to be by a generic type of resource. For instance, if you have three 'programmers' assigned, you may need to assign them, to the workplan as 'programmer1', 'programmer2' and 'programmer3'.
11. If you are using a tool to do the initial scheduling of the project, do so now. Based on the effort hours, resources and constraints, the tool will calculate the overall timeline.
12. Now check for resource constraints, to see if resources are over allocated or under allocated. (If you have a large project and are not using a tool, this will just about be impossible.) What you may find is that a resource may be allocated for 100 hours one week and 20 hours the next week. Smoothing out this workload is called resource leveling. Techniques for leveling resources include:
 - Scheduling activities sequentially, even though they could be done in parallel if not for resources constraints. For instance, two activities, each estimated at 40 hours, may need to be worked on at the same time. However, the same resource is needed to work on both. In this case, one activity needs to be schedule for one week, and then the other activity needs to be done afterward. This will work if both activities are not on the critical path.
 - Move work from one person who is over allocated, to another person with similar skills that is under allocated in the same timeframe.
 - Look for slack elsewhere in the schedule and push some work there. For instance, an activity may have 5 days duration, but can be completed within a 30-day window. The resource may need to work on many other activities first, but have some available time toward the end of the 30 days. In this case, the more flexible activity can be scheduled later, perhaps after many others have completed first.
 - Change the resource mix. If two (or more) people are assigned to an activity, see if one person can be freed up to work on another activity that is resource constrained, even if the first activity now takes longer to complete. Likewise, can additional resources that are under allocated be added to an activity to accelerate its completion and then allow another activity to be started earlier?

Adjust Plan and Add Milestones

13. After you have estimated the effort for each activity and assigned resources, you can schedule the project and see how long it will take (duration). At this point, you have your first real draft of a workplan. If you have assigned resources costs, you can also see the project costs, at least in terms of labor.

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14. Review the workplan and timeline to see if it makes sense. If it doesn't work for you, then make changes and reschedule. For instance, the tool may tell you the project will take ten months, but you only have eight months to get it done. At this point, you can look at alternatives such as adding resources, working some overtime, removing some of the work activities, etc.
15. Determine when key deliverables will be completed and assign milestones to those events. A milestone is an activity with zero duration, and is used to help manage the work at a high-level. If you (or your manager) run a report showing the project milestones, you should be able to quickly tell whether you are on schedule or ahead / behind schedule.
16. Once the workplan has been completed and the project is approved, save a current copy of the workplan as a baseline version. Later on, when the workplan is being managed, the updated workplan can be compared against this original baseline version to determine variances.
17. A very early decision needs to be made as to whether you will capture actual effort hours and cost on the workplan. For instance, you estimated an activity to have 40 hours of effort and ten days duration. It is easy to know when the activity has completed. However, are you going to keep track of whether the effort was actually 40 hours? Capturing actual effort hours requires much more diligence on behalf of the project team to keep track of their time per activity, and report it back accurately. There is a lot of value associated with capturing actual effort hours, including helping make future estimates more accurate, and being able to gather more detailed reports from the project management tool. However, many projects use the effort hours to estimate costs and help set up the workplan, but then only track when activities are completed by duration or end date.

2.1.1 Build the Workplan / Process / Estimating

This section takes you through a process for estimating effort, cost and duration. The place to start is estimating effort hours. Duration and cost can be derived using the effort as a starting point.

Before You Begin

1. Before you begin: Get a clear picture of the work that is being estimated. Many problems with estimation come because the estimator is not really sure what the work entails. You should avoid estimating work that you do not understand. This should not imply that you can know every detail. The estimating contingency (explained later) is a way to reflect some of this uncertainty.
2. Determine who should be involved in the estimating process. Does the Project Manager know enough to make the estimates on their own? Maybe not. Look for estimating help from team members, customers, subject matter experts, etc. This will usually result in the estimates being far more accurate than you would get by yourself.
3. Determine if there are any estimating constraints that you should be aware of. For instance, is the end date fixed (time boxed)? Does the customer need six-sigma quality in the deliverables, or will the 80/20 rule apply? Is there a fixed budget that cannot be increased? Knowing these constraints will help the estimators make valid assumptions regarding the whole cost/speed/quality balance.
4. Use multiple estimating techniques if possible. When you get ready to do estimates, there are a number of techniques that can be used. Where possible, try to use two techniques for the estimates. If the estimates from multiple techniques are close, you should have more confidence in your numbers. If they are far apart, it means you may need to review the estimate, or try to find other techniques to see if one estimate can be validated.

Estimating Effort

1. Determine how much detail you need to provide. The more accurate the estimate, the more detail is needed. On the other hand, if you must provide an estimate back in short notice, the documentation will necessarily be at a higher level (and the contingency will be higher).
2. Create the initial estimate of effort hours, using techniques described in 2.2.1 Estimating Techniques.
3. Factor the effort hours based on the resources assigned (optional). Your estimates are probably based on the effort it will take an average resource to do the work. Sometimes you also have knowledge of the exact resource, or the type of resource that will be assigned. If you do, then you may want to factor the estimate up or down. For instance, you may estimate an activity to take 40 effort hours. However, you also know that the person who will do the work is an inexperienced trainee. In this case, you may want to double the estimate to 80 hours. Another set of activities may be estimated to take 200 hours. However, you know that you will hire an experienced contractor to do the work, so you

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may be comfortable reducing the estimate to 150 hours. Obviously, this step can only be performed if you have some sense for the actual resources to be applied to the project.

4. Add contingency hours. Contingency is used to reflect the uncertainty or risk associated with the estimate. If you are asked to estimate work that is not well defined, you may add 50% contingency or more. If the estimate was required on short notice, a large contingency may be required. Even if you have time to create a reasonably accurate estimate, contingency may be 10-25%. Not adding contingency would mean that you are 100% confidence in your estimate. This may be the case if similar types of projects have been done before. When you add contingency, include it as a separate line item. Do not add contingency by padding the estimates of all the underlying activities.
5. Add project management time. That is the whole purpose of this website - to explain what it takes to successfully and proactively manage a project. This takes effort and there will be an associated cost. In general, add 15% of the effort hours for project management. For instance, if a project estimate is 12,000 hours (7-8 people), then a full-time Project Manager (1800 hours) is needed.
6. Check that you have included hours for indirect project resources as well. For instance, will you need any freelance people? Will you need a data architect? Will you need training specialists? Administrative help?
7. Consider rework (optional). In a perfect world, all project deliverables would be correct the first time. On real projects, that usually is not the case. Work plans that do not consider rework can easily end up underestimating the total effort involved with completing deliverables. This is not to be confused with scope changes. If you produce a deliverable that does not meet all the original requirements, or has a quality problem, then rework may be required. If the original deliverable is not acceptable because of additional requests for new features, functions or requirements, then scope change management should be utilized. There are a number of ways to factor in the effort and time associated with rework.
 - Add into the original estimate. This is probably the most typical approach. If you think that a deliverable will take 50 hours to complete, you may be mentally considering the work required for one set of corrections, or maybe two.
 - Add as separate activities. In this approach, you estimate the effort of completing the deliverable the first time, and then you add a second set of activities, effort and duration for making corrections and recycling a second (and third) time through.
 - Add as blocks of time. Rather than associate rework with individual deliverables, add a block of time at the end of a phase for rework. This is really adding a general budget and schedule pad to help absorb the rework time associated with a group of deliverables. The effort and time associated with the block could be based on individual rework estimates, or just a percentage of the original development time.
8. Calculate the total effort by adding up all the detailed pieces.
9. Review and adjust as necessary. Sometimes when you add up all the pieces, the estimate seems obviously high or low. Go back and make adjustments to your estimates to better reflect reality. Also make sure that your estimating model is consistent and reasonable. For instance, if a repetitive activity is planned, it may be the case that the effort to complete it will decrease as it becomes routine. Also make sure that similar activities have similar effort estimates.
10. Document all assumptions made during the estimating process.

Estimating Duration

If everyone worked eight hours per day, and was absolutely, 100% productive for all that time, you could easily calculate duration by taking the number of effort hours, divide by the number of resources, divided by the number of hours they work per day. For instance, if an activity was estimated at 80 hours, and you have one person assigned, and they work eight hours per day, the duration would be $(80 / 1 / 8) = 10$ days. Likewise, if four people were assigned, the duration would be $(80 / 4 / 8) = 2.5$ days.

However, those perfect circumstances are not indicative of how work is actually performed. Therefore, the following steps will help to more accurately determine the duration of the work based on the estimated effort.

Convert effort hours to duration for resource-constrained activities using the following process. Whereas effort is normally given in terms of hours, duration is given in terms of days, and an end date. It could be confusing to say that the duration of a project is three months, since you don't know if this means that the duration is actually 90 days, or 60 work days. What you

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should say instead is that the project duration is 90 days, and the estimated end date is 31 December 2002. Then the number of days of duration, as well as what the targeted end date, is clear.

1. Start by determining how many productive hours per day a person is actually going to work. In other words, if an activity is scheduled to take 40 effort hours, it is unlikely that it can be completed in a calendar week, without overtime. For further information, see 2.1.5 Estimating Productive Hours Per Day.
2. Determine how many resources will be applied to each activity. Obviously two resources may be able to complete an activity faster than one person, but it may not be twice as fast. Similarly, a third person may allow the task to be completed sooner, but not in one-third the time. At some point, adding resources will not make the activity complete any sooner, and in fact, may make it go longer.
3. Factor in available workdays, taking into account holidays, vacations and training. This was not included in the productivity factor in the first point, since this non-project time can be scheduled and accounted for in advance. For instance, on a three-month project, one team member may be out for two holidays, while another may also have ten days of vacation.
4. Take into account any resources that are not full time. If you have a resource 50% of the time, it will take them twice at least twice as long to do any individual activity. But also look at what type of non-project work. If a team member has a 50% block each day, or can work 20 hours in a row per week, they will be more productive than a person who works 20 hours a week, but is constantly being interrupted from a half-time support role.
5. Factor in multi-tasking productivity loss for part-time resources. You can do this if you have a sense for the actual resources that you will use and what additional work they will be doing. (If you do not have this detailed information, you cannot easily factor in multi-tasking productivity loss, although you may be able to deduct a generic average of some type.) If one person is working on multiple projects, or perhaps a combination of projects and support, a further reduction in productivity needs to be taken into account. This reflects the fact that if a person is shared on two or more unrelated efforts, it takes time to stop one and start up another. If a person is on two projects for 20 hours each week, they are going to lose additional productive time switching back and forth. If the person is on two projects, this might result in a 10% loss of productivity on both projects. If they are on three (or more) each effort could take up to a 20% productivity hit. For example, if a person was split between three projects for 14, 14 and 6 hours, the project managers should factor in closer to 11, 11 and 5 for the actual number of productive hours worked.
6. Calculate delays and lagtimes. Some activities have small effort hours, but a long duration. For instance, if you will be waiting for vendor supplied resources. Or if you need to get a deliverable approved.
7. Determine what can be done simultaneously. Assuming you have enough resources, many activities can be done in parallel. This should be reflected in the project plan, and it will help compress the schedule. On the other hand, recognize that not all activities and team members are interchangeable. There may be a series of activities that need to be done sequentially because only one person has the right skills to do the work.
8. Document all assumptions.

Estimating Costs

1. Looking at effort hours and determining an hourly rate derive the cost of labor. In many companies, estimated labor costs for internal employees are assumed to be zero, since their costs are accounted for in a departmental budget. In other companies, employees are assigned an internal hourly billing rate. In either case, external contract or consulting resources need to be estimated. If you are not sure whether the staff will include external resources or not, you need to make some assumptions and document them with the estimate.
2. Include all nonlabor costs, including:
 - Hardware and software
 - Travel expenses
 - Training
 - Team building
 - Facilities

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- Maintenance / support costs (if you need a total ownership cost. Estimate maintenance costs at 15% of the development cost per year.)

3. Document all assumptions.

2.1.2 Build the Workplan / Estimating Threshold

The process of creating a work breakdown structure requires a repetitive process of breaking larger chunks of work into a series of smaller and smaller pieces. An appropriate question to ask is how small should the activities be before they are not broken down further. This is the estimating threshold, under which it makes no sense to break down the work any further. There is no hard and fast rule for the threshold, but there are some general guidelines and then some caveats where different rules might apply.

For a large project, any pieces of work that are greater than 80 hours of effort should be broken down into smaller pieces. In other words, there should not be any activities on the workplan that are over 80 hours. However, the threshold may be smaller, and probably should be smaller. If your project is medium sized, the activities remaining should be no larger than 40 hours. If the project is smaller, break down the activities into work no greater than 20 hours. Remember that this threshold is an upper limit. In 2.1.1 Estimating Process and 2.2.1 Estimating Techniques.)

Caveat #1: It is possible that activities that are to be worked on in the distant future may not be able to be broken down into chunks larger than the threshold, because there may be too much about them that is unknown. If this uncertainty involves just a few activities, then it is okay to leave the work at a higher level. However, if it becomes hard to define and estimate this future work, then the best approach is to break off this entire effort into a separate project, outside the scope of the one currently being planned. For instance, it may be hard to plan and estimate the work for construction and testing without first having the business requirements. In this case, the initial project would be planned to gather the business requirements, with a follow-up project to design, build and test the solution. Based on the results of the first project, the second project can be laid out and estimated accurately. With that being said, if you do not have the option of multiple projects, this future work can be left at a level higher than the threshold. The risk, of course, is that the estimates will have more margin of error and you may need to deal with the consequences of exceeding your project budget when you get closer to this work.

Caveat #2: One of the reasons to break down activities into smaller pieces is to gain clarity on exactly what needs to be done. If an activity is fairly obvious to the person who is assigned, then it may not need to be broken down much further than the threshold. If the work that is represented in the activity is not well known, then it may be broken down further for clarity. For instance, if an activity that is estimated at 70 hours has never been done before, then it may need to be broken down into a series of smaller activities to ensure that the people who are assigned know exactly what is expected.

Duration Threshold:

In general, the duration of activities should be broken down to a level no larger than the project work reporting cycle. For instance, if you receive a formal status update from your team every two weeks, then the duration threshold should be no more than 80 hours. If you have a status meeting weekly, then the activities should be no more than 40 hours. This rule ensures that there will be no more than two status periods before an activity has been completed or is flagged as late. As an example, if you meet with your team weekly and the activity duration is not more than 40 effort hours, then no activity will be active for no more than two status meetings before it is completed. On the other hand, if you have an activity that has a duration of 200 hours, it is possible that up to six status meetings will go by before you know for sure whether the activity will be completed on schedule or not. This is an example of where the activity needs to be broken down at least one more level. Smaller activities allow problems to be uncovered and surfaced much earlier.

2.1.3 Build the Workplan / Approach

The project approach is a section in the **Project Definition** that describes in words the thinking that goes into the creation of the **Project Workplan**. This information is for the benefit of the customer and stakeholders who will not be able to easily interpret the actual workplan. There are a number of ways the section can be prepared. Usually, you start off with general content about how the organization and environment will impact the project. Then you walk chronologically through the

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project, starting at the beginning and going to the end. Of course, you don't describe the detail at an activity level. You want to stay at the milestone, stage or phase level.

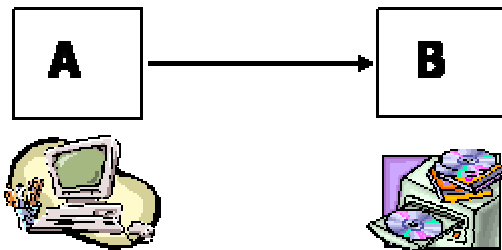
People struggle with this section, so the following information is provided to give you more detail and examples of the areas that can be described. You will notice that much of this information may be available elsewhere, but it is in this section that you tie everything together in context for the benefit of the reader.

- Discuss whether any broader company initiatives or strategies impacted how this project was structured.
- Identify any constraints or time-boxes in terms of budget, effort, time or quality, and the impact to the project.
- Describe any company standards that will impact how the project is executed.
- Note any company or industry best practices that will have an effect on the project.
- Describe other options for the overall approach, and why you chose the one you did over the others. Note why you think this approach has the best chance of success over the others.
- Talk about how the deliverables will be supported and maintained after the project ends. Also indicate whether the approach was influenced by the support and maintenance implications.
- Discuss any other related projects that are completed, in progress or pending that influenced the approach for this project, and why.
- Discuss, at a high level, how the project will progress from start to end, and what the interdependencies are between the high-level stages.
- Discuss any techniques that might be of interest to the reader. For instance, if the requirements will be gathered in a three-day Joint Application Development (JAD) session, note this in the approach.
- Note whether new technology or new processes are being utilized, and why.
- Identify any unusual staffing requirements, such as consultants or outside specialists, and explain why you need them.
- Describe the use of outsourcers, contractors or vendors, especially if they are doing significant work.

Remember that the purpose of the approach is to describe these factors and the impact they have on the project workplan. This section is for the benefit of the reader, even though the writer already knows the information. There is a tendency to write this section briefly and quickly, therefore providing little value to the reader. If the writer is diligent and provides good context, this section can instead prove to be very valuable information for the reader.

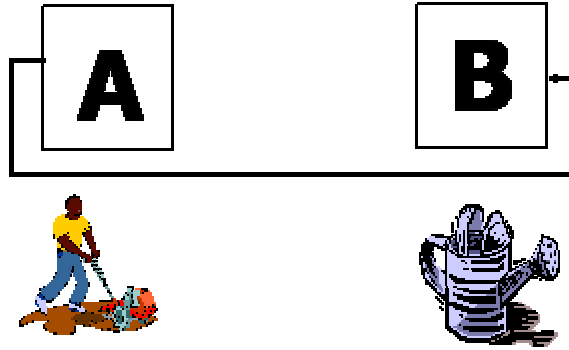
2.1.4 Build the Workplan / Precedence Relationships

When you are building the Network Diagram, you will find that all of the activities in the work breakdown structure are related to at least one other activity. In many cases, the relationships will involve more than two activities. The most common case you will find is where one activity cannot start until another activity has finished. This is referred to as a Finish to Start relationship, and it is the most common form. However, there are four ways that one (or more) activities can be related to another one (or more).



Finish to Start, Activity B cannot start until Activity A has completed. For instance, you must buy a new computer, before the new software can be installed

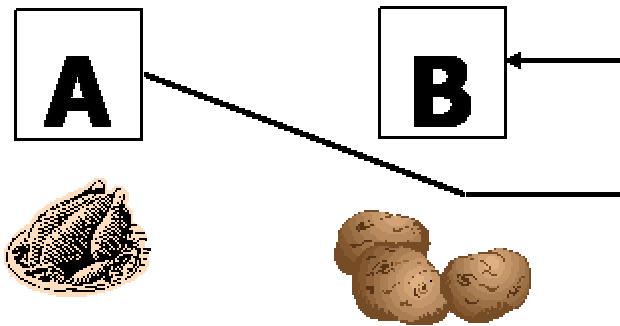
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Start to Finish, Activity A must start before Activity B can finish (rare). For instance, you must start fertilizing the garden, before I can finish watering the garden



Start to Start, Activity A must start before Activity B can start. For instance, you must start painting the walls, before wallpaper can be hung



Finish to Finish, Activity A must finish before Activity B can finish. For instance, the turkey must finish cooking before the potatoes finish cooking

2.1.5 Estimating Productive Hours Per Day

It can be challenging to providing project estimates for effort hours, duration and cost. Of the three estimates, you must start off with an estimate of effort hours. Without an idea of the effort hours, you cannot accurately estimate duration or cost.

One of the key factors in converting an estimate of effort hours into duration is to determine a standard for how many productive hours of work you will experience in a typical workday. For example, if you have an activity that you estimate will take forty effort hours, it is unlikely that it can be completed in five eight-hour calendar days. There are many additional work and personal activities to factor into the estimate as well. Without taking these into account, it is likely that you will hit your estimates for effort hours, but run over your duration estimates. You need is a "reality factor".

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First make sure you have an estimate of effort hours. Then, keep the following steps in mind to convert the effort hours to the actual duration or calendar days of work.

Start by determining how many productive hours per day a person is actually going to work. There are normal non-project activities that come up during the day that need to be accounted for. This includes departmental meetings, social conversations with co-workers, doctor's appointments, sick time, administrative activities, going to the bathroom, etc. You could try to come up with the number of productive hours per day your specific team works, but it would be very tedious. A generally accepted ballpark number for average productive hours per day is 6.0 to 6.5, based on an eight-hour day.

This does not mean that in any one day a person may not be productive for the full eight hours. However, it does factor in a person's productive hours per day over time. For instance, in a 40 hour week, one of your team members may have a one hour department meeting, spend three hours socializing, leave two hours early one day for a doctors appointment, spend one hours on administrative requests, spend one hour on the phone for non-business reasons and spend one hour going to the bathroom and the break room (12 minutes per day). So, during that week, the person was available for 31 hours, or six hours and twelve minutes per day.

Share with the team what the assumptions are for each person. Let them know your scheduling assumptions for them and why you are expecting that. They then have the responsibility to tell you if outside influences are making it difficult for them to spend the allotted time on the project. That will give you the input you need to change their work responsibilities, or else change their availability factor.

2.1.6 Build the Workplan / Work Breakdown Structure

This page describes additional best practices, tips and processes for building the Work Breakdown Structure (WBS).

Summary Activities

If you look at a WBS activity and determine that one of them need to be broken down to another level, the original activity becomes known as a "summary" level. A summary level does not have any work or hours specifically associated with it. It represents a logical roll-up of the activities that are under it. When you build your workplan, you really only need to include the detailed activities, not the summary ones. However, for the sake of clarity and readability, it often makes sense to include these higher-level summary activities in the actual workplan as well. If the summary activity includes the building and completion of a major deliverable, the summary could also represent a milestone.

Since you chose to break a summary activity into smaller tasks, it does not make sense to only have one detailed activity under a summary one. If you have this case in your WBS, you either need to:

- Break the summary activity into multiple smaller tasks.
- Get rid of the detailed activity, and associate the work with the summary - which now becomes a detailed activity.

Another rule of summary activities is that once the detailed activities are completed, all the work represented by the summary activity must also be completed. If there is more work required, then additional activities must be added under the summary.

Use the Old-Fashioned Approach - Yellow Sticky Pads

It is amazing how many people use yellow sticky pads and a blank wall to create the first draft of the Work Breakdown Structure. The approach is very easy. You first get the appropriate people into the same room. These are the project team members and customers who have the expertise to build the WBS. Typically you start off by writing the names of the major deliverables on yellow sticky sheet - one deliverable per sheet. Make sure you have agreement with the major deliverables to begin with. If any of the deliverables is very large, you can create new sticky sheets that describe the deliverable at a lower level. These are arranged under the higher-level deliverable. The deliverable needs to be identified at a level low enough that you understand what it takes to build it. In general two levels should be enough. One level is typical. Next, for each deliverable, describe the activities that must take place to complete it. Each activity goes on a separate sticky sheet. Again, these are arranged under the specific deliverable they refer to. If you have a sense for the order that the activities

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need to be completed, you can arrange the sticky sheets sequentially. However, this is not important at this point. The important thing is to identify all the work.

Look at the activities for each deliverable and see if they meet your threshold criteria. If they do not, identify the more detailed activities that make up the higher level one. Continue with this process until the work required to complete all of the deliverables are defined, as best you know today. The levels of activities will not be the same for each deliverable. Some simple deliverables may meet the threshold criteria in one or two levels. Others may take three or four.

The advantage of this approach is that your team can visually see the work, and they can help ensure all the work is identified to complete the project. The yellow sticky sheets also give you the ability to easily move things around. If you add an activity and then decide to remove it, you just pick up the sticky sheet. Likewise, if a deliverable or group of activities is in the wrong place, you just move the sticky sheets to where they need to be.

When you are all done, you can enter the summary and detailed work activities into your workplan management tool.

Focus on Deliverables, Then Activities

Sometimes people have a hard time getting a WBS started because they are not sure what to put at the very top, and they are uncertain about how to break the work down from there. Although there are many ways that the WBS can be started, ultimately you want to focus on deliverables. If we assume that the top level is the overall project (level 0), then the next level has to start encompassing the actual work. After the deliverables are described, the activities can be defined that are required to build the deliverables. The project plan is ultimately made up of activities, but they need to be developed in the context of completing deliverables. There are a number of options for defining the WBS at level 1.

- It might make sense to place the major project deliverables directly at level 1, and break the deliverables into smaller components on the next level, if necessary.
- Another option for level 1 is to describe the organizations that will be involved, such as Sales, Marketing, IT, etc. The next level should describe the deliverables that each organization will produce.
- A third option is to look at level 1 in terms of the project life-cycle, for instance analysis, design, construction, testing. Again, if that is the best logical way to look at level 1, then level two should describe the deliverables produced in each life-cycle stage.

You see that the top level can start with deliverables, or else start with another way to logically group major portions of the project. However, if you chose another way to initially organize your thinking of the project, you need to transition immediately from there to deliverables, and then move to the activities necessary to build the deliverables. See 2.1.6.1 WBS Examples for more information.

How Big Should an Activity be?

When the team is creating the workplan, there is a question as to what level the work breakdown structure should go. How do you know when to stop breaking the work down into sub-activities, and when is the activity already broken down enough? Part of the answer is to utilize an overall estimating threshold, as described in 2.1.2 Build the Workplan / Process / Estimating Threshold. Other things to take into account include:

- The activity should contain sub-activities that are related and continuous. For instance, if you had an activity called 'Create Testing and Training Strategy', it probably should be broken down further, since the Testing Strategy and Training Strategy are not necessarily related, and they are not necessarily continuous.
- The activity should be able to be completed by the same person, or same group of people. If you have an activity that requires different people for different sub-activities, then it should be further broken down into the sub-activities.
- The activity needs to be fully understood by the Project Manager and the person(s) who are assigned to the work. If you have an activity that is not understood by the people assigned, then it should be further broken down into its sub-activities to provide further clarity as to what is involved to complete it.
- In general, the work should be broken down to a level that makes sense for the Project Manager to control. Theoretically, the workplan could be broken down to where each activity was one or two hours. Obviously, this does not make sense. For sure, you do not want to schedule activities with less than one hour of effort.

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Do Not Make the WBS Too Tall

If you envision the WBS being built with sticky sheets on the wall, it is important that you not let the number of levels get too tall. Depending on your WBS approach, it may take you one to three levels to get the deliverables defined. The general rule of thumb is that the level of activities should not exceed five, and even that number of levels might be extreme. Smaller projects may not need more than two or three levels of activities. If you have a very large project, the levels might be larger. However, there is a point where the detail required to add relations and dependencies later on will be too complex to manage. If you find that you are defining down to five or more levels of activities, stop and evaluate what you are doing. First, you may be defining the work at too low a level. Second, you may have defined your deliverable too broadly. In that case, see if a large deliverable can be broken up into smaller, integrated pieces. The work associated with the smaller deliverables should not require so many levels.

Phase and Stages

There are differing terms used to describe the ways that large projects can be divided and subdivided. A couple of the common terms are phases and stages. There may not be universally recognized definitions for these terms, but in general they mean the following.

- **Stage:** This is the easier term. This is usually always used to signify an internal breakdown of work on one project. For instance, you might refer to the gathering of business requirements, and all related work, as the Analysis Stage. Similarly, if your project requires the building of a prototype, you might call this the Prototype Stage.
- **Phase:** Phases can have two meanings. In many cases, the word 'phase' means exactly what was just described as a stage. For instance, a project may have a Requirements Phase or a Prototype Phase. In that context, phase is a high-level breakdown. If the term 'stage' is also used, it refers to a further subdivision of a phase. For instance, in the Analysis Phase, there may be a Business Requirements Stage and a Strategy Definition Stage.

The other usage refers to a series of independent, but related projects. For instance, the original execution of a project to deliver basic functionality might be referred to as Phase I. A subsequent project to add more functionality might be called Phase II. A rollout of the package might be Phase III. In all these cases, the term 'phase' is used to imply a separate project, but one that is related to similar projects in a series that come before it and after it.

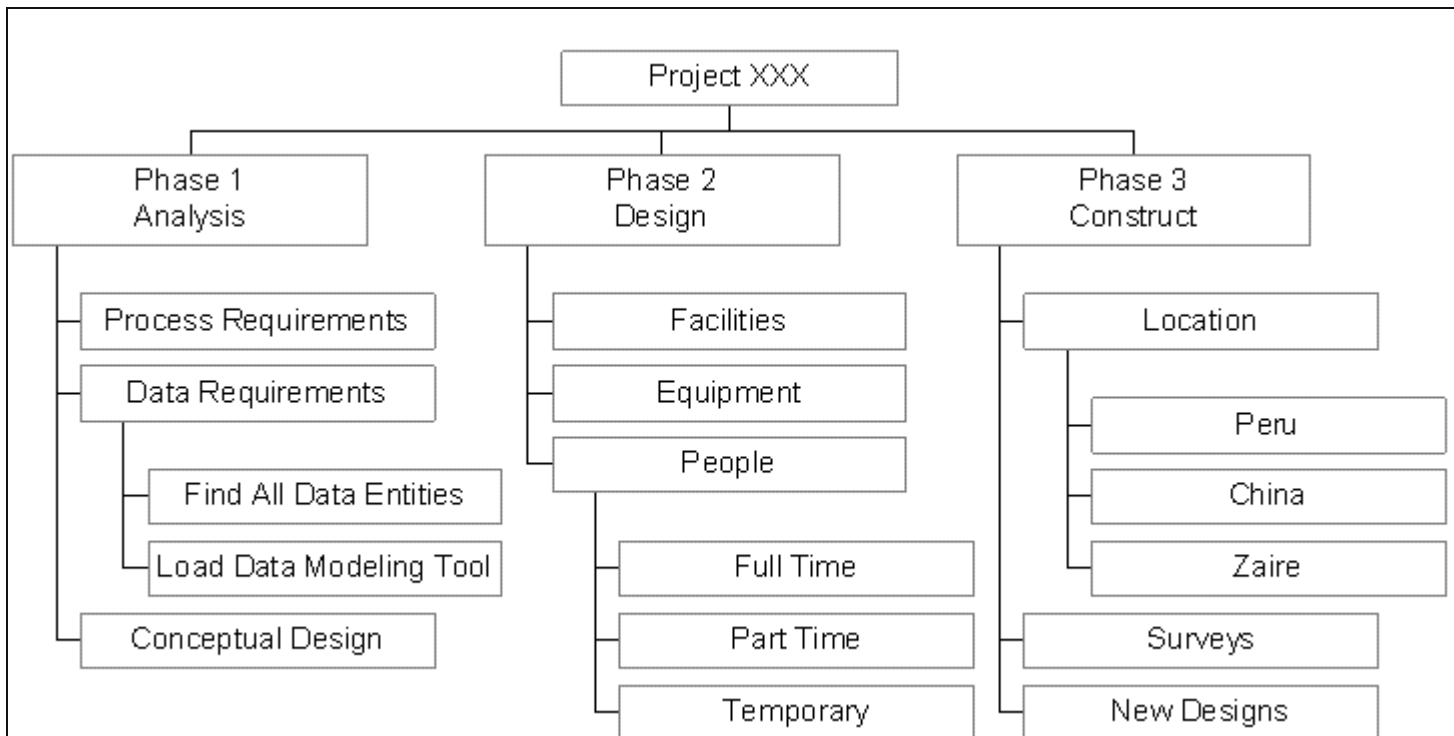
2.1.6.1 WBS Examples

As noted previously, there are a number of ways to create the Work Breakdown Structure (WBS). Remember that the WBS is the first step toward creating the project workplan. It is not the workplan itself. It is important to use the WBS to identify all the major work to be done. It is not important to break the work down into levels or patterns that provide a sense for the timing and sequencing. This will all be done later.

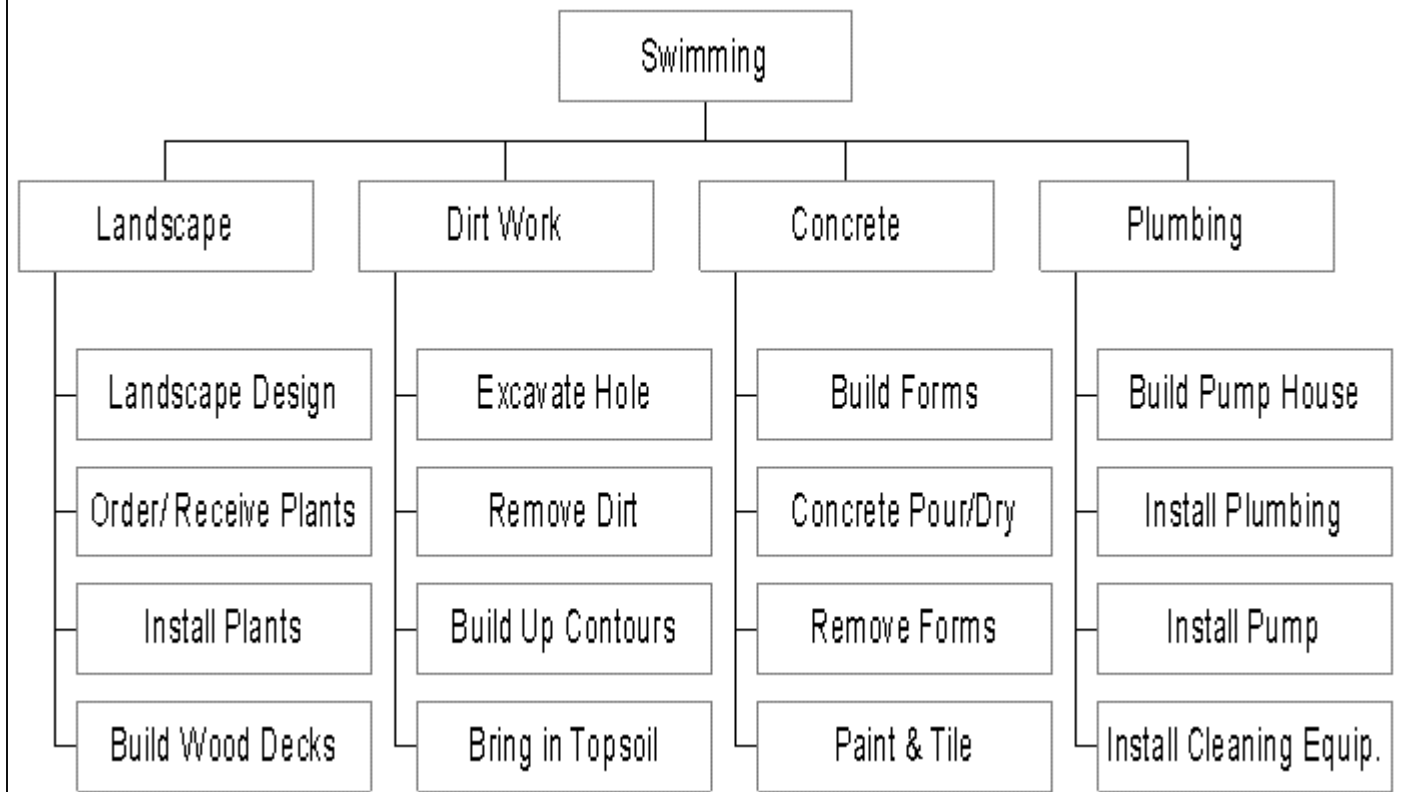
Here are some examples of how the WBS can be structured.

WBS by major project phase or work unit. This example shows the major phases required, but they do not have to be in the Correct time-sequence. Just determine what the major pieces of work are and break each one down further. (Many of these boxes will be broken down much further into the activities required to execute the work.)

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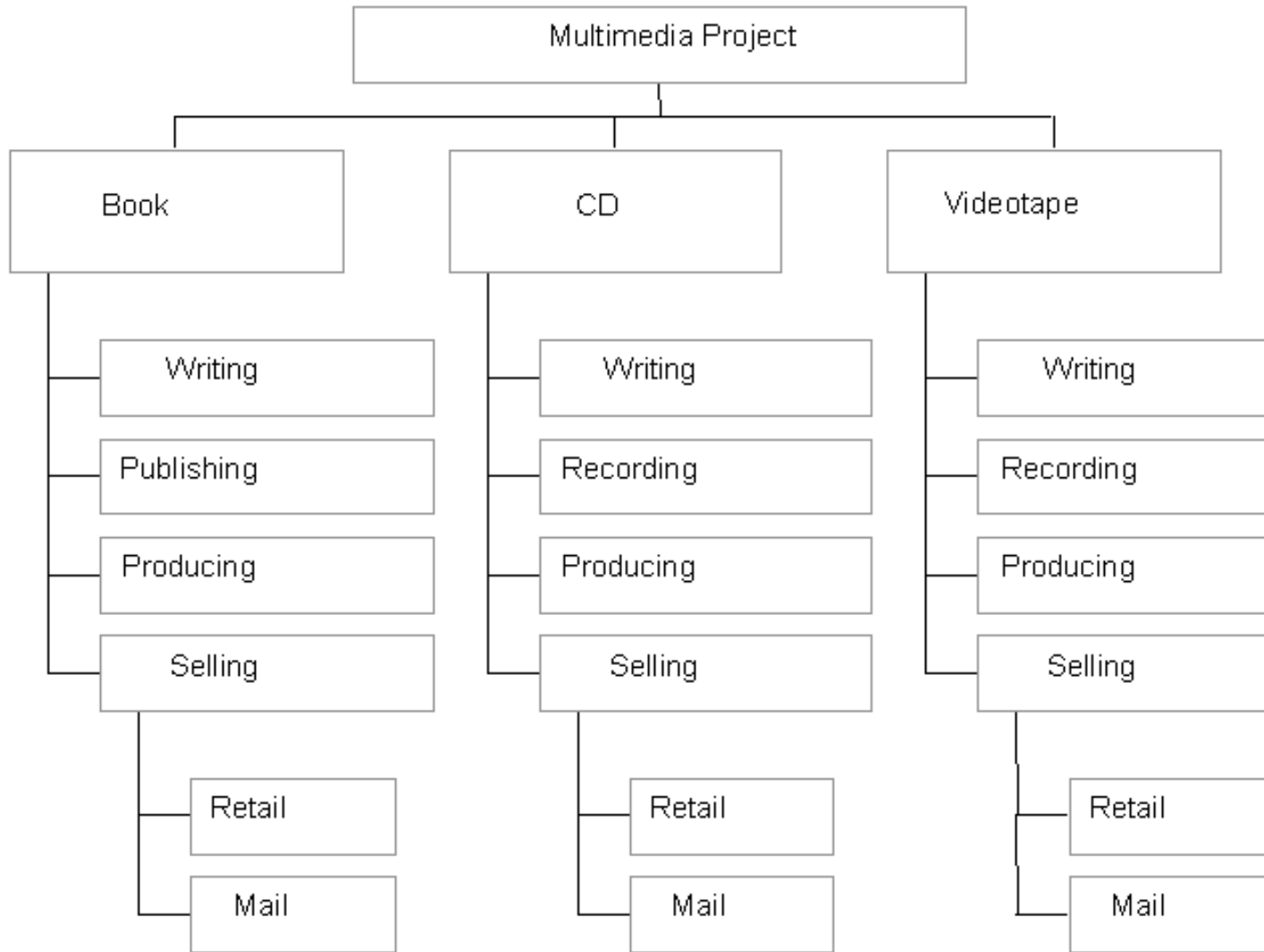


WBS by timeline. In this example, the team has actually built a WBS sequentially based on the order the work should be performed. This may be easier to think through in some projects where there is some experience in knowing how the timeline will lay out.



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WBS by deliverable. First determine all the deliverables that the project will produce, and then break them down into the work required. Again, this does not imply sequencing. Many of these activities may end up being executed in parallel.



2.2 Build the Workplan / Techniques

Use Previous Similar Work plans and Pre-Built Workplan Templates

The process described for building a **Project Workplan** for medium and small projects uses the Work Breakdown Structure (WBS) technique. However, the best way to build a workplan is to reuse one that was created previously. For instance, if a similar project to yours was completed in the past, start by using that workplan as your base and modifying it accordingly. This will save all of the effort associated with 'rediscovering' how the work should be laid out. This is especially valuable if the

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previous Project Manager kept the workplan up-to-date. Then you will have the actual workplan that was used to complete the similar work.

If your company uses a formal methodology, it may come with workplan templates for projects with certain characteristics. For instance, they may have a pre-built template for implementing a packaged solution, or an Internet solution, or a rapid application development solution. In this case, see if the approach you are using for your project matches one of the templates. If so, then it can be used as a starting point. Be careful however. Pre-built templates from a methodology tend to be large and complicated, because they want to be applicable for all projects of this type. After determining that the template is a match, the Project Manager must evaluate the steps of the template and determine which ones are applicable to this project. Those that are remain in the workplan. Those that are not needed are discarded.

Always Assign One Person to be Primarily Responsible for Work

A common mistake is to assign two or more people to an activity without designating who has the primary responsibility to ensure the work is done correctly and completely. A lack of primary responsibility may make some people defer to each other, delay work that needs to start now, work on activities that have a lower priority or flounder without knowing who to talk to. If an activity has only one person assigned, it is pretty clear who is responsible. But if two or more people are assigned to the same activity, make sure one of them is designated as the primary person to coordinate and ensure the work is done completely, correctly and within quality, effort and duration estimates.

Assign Generic Resource Groups First, Then Specific Resources

In many cases, you are not sure who the resources are that will be assigned to your team while you are developing the project workplan. This will especially be true for resources that are not needed until further out into the future. In these cases, use a generic resource description as a placeholder in the project workplan. For instance, you may need a data modeler three months after the project starts. In the workplan, refer to this person with a generic name of Data Modeler #1. Then, as time gets closer to actually needing the person, you can update the workplan with the exact name of the person who will do the work. This also helps the Project Manager better estimate the work. Sometimes when you know who will do the work, there is a tendency to create an estimate based on that person's track record. If the person does not end up working on the project, your estimate could be way off. However, if you will estimate the work based on a generic role, you probably will be okay no matter who the actual resource is that does the work.

Use Full-Time Project Resources When Possible

In many cases a project team is made up of full-time and part-time staff. Usually that is a function of the size of the organization, the size of the project, available resources and how the functional department is organized. However, if you have the ability, your first choice should always be to utilize full-time resources on your project. Taken to the extreme, you will get much more done with one full-time resource, than you will with five resources that each are assigned for 20%. Part-time resources have competing workloads, competing priorities and competing managers. This is especially the case if people have part-time project and part-time support responsibilities, since normally production support issues have priority over the project. Also, in many cases, people are not able to effectively allocate their time across projects as they are requested, which results in the need for more oversight on the part of the Project Manager. Lastly, there is a productivity cost to having to switch from one type of work to another. The team member needs to ramp down from their current work and ramp up with the second assignment. If there are three sets of priorities, even more thrashing occurs, and less productive work gets done.

Who is the Best Person to Write the Project Workplan?

The Project Manager is the person who has the responsibility to successfully execute the project. They are the person who must create the workplan and believe in it. If it was necessary for someone else to create the initial workplan, this should be reviewed and modified by the Project Manager to ensure they buy into the timeline and the deliverables to be produced. Otherwise, it is too easy for the Project Manager to opt out of the responsibility to deliver, by saying that they cannot be held accountable for a workplan that they did not create.

That being said, the Project Manager does not usually have the expertise to build the plan entirely on their own. There are two main techniques for gathering all the information required to complete the workplan.

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- **Create draft and circulate to stakeholders.** In this approach, the Project Manager creates an initial draft of the workplan. There may be a subset of team members involved as well. When the draft is completed, it is circulated to the stakeholders for feedback. During the review process, activities are added, changed or deleted. If the workplan is long and detailed, this draft may need to be at a summary level. The Project Manager takes the feedback and incorporates it into the workplan, which is then used going forward in the project. This approach results in a very good workplan, and provides opportunities for feedback and buy-in from the stakeholders. The only risk is that the stakeholders may not be engaged in the project yet. This may result in them not focusing enough on the workplan, or else not knowing enough to provide valid feedback.
- **Build the WBS and workplan through direct stakeholder involvement.** In this approach, the workplan is built through one or more in person sessions with the major stakeholders. It may be possible to get all the stakeholders in a facilitated session for one or more days to gain consensus on what needs to be done. If the project is large, you may need to meet with the major stakeholders in groups. For instance, you may have facilitated sessions with each functional department. Each department has a specific way of viewing the project, but consolidating the various session results can generate a complete workplan. This approach has the advantage of having active engagement and participation from the stakeholders. They should then have complete buy-in to what needs to be done and what their role is. This technique might or might not take longer and be more labor intensive than the first option, depending on how many sessions need to be run, and how soon the session results can be sent back to the session participants for validation.

Predetermined End Dates / Timebox

In a perfect world, project completion dates would be derived based on the amount of work to be done and the number of resources available. As you know, that is not always the case. Sometimes there is an arbitrary or very valid date by which the work must be completed. For instance, the end date may be determined by a government regulation, or a scheduled Board meeting, or to coincide with another company initiative. This situation is referred to as a timebox, meaning you have a fixed amount of time to get the work done.

There is nothing wrong, per se, with having a fixed end date. It provides a sense for the business priority of the project, and gives everyone on the team a sense of urgency and focus. There may be a problem, however, if the Project Manager and team do not think they can get the work done by the deadline. In that case, the Project Manager needs to raise this as an issue. Potential resolutions include:

- Assigning more resources to the project. Even though each additional resource begins to have diminished value, this is usually the first place to start.
- Having the teamwork overtime, with the understanding that overtime itself has a diminishing return for each additional hour, and that long-term overtime can actually have a negative effect.
- Working with the business customers to scale back the required deliverables due by the deadline. This may include removing entire deliverables, or functionality from required deliverables.
- Determining whether required deliverables and features can actually be delivered later than the due date. In these cases, a 90% solution may be viable at the due date, with the additional work completed soon after.

Estimating Techniques

An important part of building the workplan is being able to accurately estimate the work activities. Estimates of effort hours will, in turn, drive the cost and cycle time estimates. Although the estimating process can be complex, some techniques and definitions are provided in 2.2.1 Estimating Techniques.

Build the Workplan - Spend More Time Up-Front to Save Time Later

Doesn't it seem that most major problems that are encountered on a project tend to surface toward the end, when construction and testing is going on. In fact, some Project Managers purposely hurry through planning, analysis and design, because they figure they will catch any mistakes in testing. That's a big mistake. The longer it takes for errors to be caught, the more time consuming and expensive it is to fix them. I have been in a number of end-of-project reviews on projects that were less than successful. In every case, looking back, the team wished they would have spent more time planning before they rushed in to start the work. When you are building your workplan, allocate more time up-front in the planning and analysis portions. This will end up saving time and cost in the overall project. Spending more time in planning will save time in analysis. Spending more time in analysis makes the design; construction and testing go more smoothly. Of course, you don't want to over plan and overanalyze. That doesn't buy you anything. But be diligent in this up-front work. Don't rush through it. Do it

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right. Time invested up-front will more than make up for itself later on.

2.2.1 Build the Workplan / Estimating

Estimating Techniques

There are five-day classes that focus on teaching people good estimating techniques. Some of these techniques are based on advanced statistics and scientific formulas, which are way outside the scope of this website. The following techniques can be used at a project level or activity level, or any place in-between. For instance, an expert opinion can be used to help guide the estimate for an entire project, or a specific piece of work. The following techniques can be used to estimate effort.

- **Previous History:** This is by far the best way to estimate work. If your organization keeps track of actual effort hours from previous projects, you may have information that will help you estimate new work. The characteristics of the prior work, along with the actual effort hours are stored in a file/database. You then describe your project in the same terms to see if similar work was done in the past. If so, then you have a good idea of the effort required to do your work.
- **Analogy:** Even if you do not keep actual effort hours from previous projects, you may still be able to leverage previous work. Analogy means that you describe your work and quickly interrogate the organization to see if similar work was done in the past. If you find a match, see how many effort hours their project took, and use the information for your estimate. (If the organization does not track actual effort hours, find out if they hit their duration estimate, and then adjust their effort hours estimate accordingly.)
- **Ratio:** Ratio is similar to analogy except that you have some basis for comparing work that has similar characteristics, but a larger or smaller scale. For instance, you may find that the effort required to complete a software installation for the Miami office was 500 hours. There are twice as many people in the Chicago office, which leads you to believe it may take 1000 hours there.
- **Expert Opinion:** In many cases you may need to go to an internal or external expert to get help estimating the work. For instance, if this is the first time you have used a new technology, you may need the help of an outside research firm to provide information. Many times these estimates are based on what other companies in the industry are experiencing. You may also have an internal expert who can help. Although it may be your first time to estimate a certain piece of work, perhaps someone else has done it many times.
- **Delphi Technique:** The Delphi Technique is similar to Expert Opinion, except that you use multiple experts and try to reach an estimating consensus among them. First, identify two (preferably three) or more people who you would consider to be experts in the type of work you are estimating. Next, send them the relevant information they need to provide you an estimate of the work, along with any assumptions, risks, etc. they identify. If the numbers are relatively close, you should feel very good to use an average for your final estimate. If the estimates are not close, or if some are close but others are not, send all the estimates, including the assumptions and risks, back out for review. Ask the experts to consider the estimates, risks, assumptions, etc. of the other estimators. Then ask each of them to provide a second estimate of the work. Hopefully, you will find the various estimates closer now, since the experts have a chance to see the work of the other experts. Based on a common set of assumptions and risks, hopefully, the experts can reach a consensus estimate. If not, see if most of the experts have a similar estimate and use that number. You may have to also note an estimating risk in the direction of the experts who were not able to reach consensus. For instance, if three experts estimate work at around 1000 hours, but one expert holds to the belief that the work is 2000 hours, you may need to go with the 1000 hour consensus, with a stated risk that the numbers might be up to twice that amount, based on at least one expert opinion.
- **Work Breakdown Structure:** The process for building a workplan discussed breaking work down into smaller and smaller pieces. One of the reasons for doing this is to be able to more easily estimate the work. You may look at a large piece of work and have difficulty determining an estimate. However, as the work is broken into smaller pieces, the individual components will be easier to estimate. When you have estimated all the pieces, roll them all up for the overall effort.
- **PERT (Program Evaluation and Review Technique):** The term PERT is often used to refer to a network diagram. However, it is really the formal name of an estimating technique that used a weighted average of three numbers to come up with a final estimate. If you are asked to estimate a project or activity, you start with three estimates instead - the most pessimistic (P) case when everything goes wrong, the most optimistic (O) case where everything goes right, and the most likely (M) case given normal problems and opportunities. The resulting PERT estimate is $(O + 4M + P)/6$. For example, you estimate a piece of work to most likely take 10 hours. The best case (everything goes right) is

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6 hours. The worst case (everything goes wrong) is 26 hours. The PERT estimate is $(6 + 4(10) + 26)/6$. The answer is $72/6$, or 12 hours. Notice that the number was pulled a little toward the far extreme of the pessimistic estimate, but not by much, since the result is still weighted heavily toward the most likely value.

- **Parametric Modeling:** In this technique, a pattern exists in the work, so that an estimate of a component can be used to drive the overall estimate. For instance, if you know that you can build one mile of flat one-lane highway for one million dollars, you should be able to easily calculate an estimate for ten miles of flat four-lane highway (40 million dollars). Or, if you are asked to create 40 new reports, first estimate the effort for an 'average' report (perhaps the average of a small, medium and large report). Then multiply the average effort for a report by 40 for the final estimate.

Estimate in Phases

One of the most difficult aspects of estimating projects is not knowing exactly what work will be needed in the distant future. It can be difficult to lay out and estimate work that will be done three months from now. It's harder to estimate six months in the future. Nine months is even harder. The reason is that decisions made and deliverables produced earlier in the project have an impact on what the work looks like further along. Therefore, there is less and less precision, and more and more estimating risk, associated with work that is farther and farther out in the future.

The best approach for larger projects is to break the work into a series of smaller projects, each of which can be planned, estimated and managed to a much higher likelihood of success. (Similar rationale can be found in section 1.0 Define the Work, including breaking large projects into programs.) From an estimating perspective, the nearest project can be estimated closely, with the subsequent projects estimated with a higher level of uncertainty. When one project completes, the next project can be estimated closely, with estimates refined for following projects. This technique also provides checkpoints at the end of each project where the entire effort can be revalidated based on current estimates to ensure that it is still viable and worth continuing.

Fixed Costs and Variable Costs

You may hear the terms fixed and variable cost when you are estimating a project. Variable costs are those that change relative to how many units are being used. The obvious variable cost on a project is labor. The more hours you use from a person, the more the cost to the project. The cost often depends on the particular resource as well. An internal employee may have a cost of \$30 USD per hour (plus benefits), while a similar contract resource might cost \$60 USD per hour.

Fixed costs are those that are basically the same for the project, regardless of the resources being used. For instance, if you were building a house, the lumber and concrete cost would be pretty much fixed, once the design was agreed to. If you outsource part of a project to a third party for a fixed price, it becomes a fixed cost to the project as well. (Even if the work takes longer or shorter than estimated, your project cost should still be the agreed upon fixed cost.)

Time-Constrained and Resource-Constrained Activities

Activities can be classified as time or resource constrained based on whether the duration can change if more resources are applied. An activity is resource-constrained if the duration changes based on the number of resources applied. For instance, you might estimate that it will take 200 hours for one person to build a roof on top of a house. If the person worked forty hours per week, it would take five weeks to complete the job. If you applied two people to the job, the effort might still be 200 total effort hours, but the job would only take 2 1/2 weeks to complete. If there were five people assigned, the work could be done in one week. (Of course, the duration might not drop as cleanly as this example. It might take 8 days total.) An activity is resource-constrained if the duration is based on the amount of resources that can be applied to the activity.

On the other hand, if an activity is time-constrained, the duration remains the same regardless of the number of resources applied. For example, if you attend a one-day class, the activity will take eight hours of time. If you send two people to the class, the class does not get shorter. It still takes eight hours. Likewise, the number of people involved does not impact the time it takes for concrete to dry, or to mail a letter. They just take a certain amount of time. If applying resources has no impact on the project duration (or very little impact), then the activity is time-constrained.

Consider Meetings and Collaboration Time

Don't forget any scheduled meetings or planning collaboration that will occur on the project. For instance, if you have a planned weekly status meeting, make sure you add in the (team members * one hour * number of weeks). Likewise, if you are planning code walkthroughs, make sure you account for the time of all participants. When you are circulating documents for approval, include some review time for each person that you think will be involved. If you are planning on having review

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meetings at the end of each milestone, make sure to include time for each participant. Also include time in the estimate for team building activities.

Start Off With an Estimate Range

There are many times when you are asked to give a high-level estimate for a project or an individual work activity. Usually you are asked to produce a number, for instance 1000 hours. However, if at all possible, these high-level estimates should be given in a range. The range reflects the level of uncertainty for the estimate. For instance, a high-level estimate might only be accurate to within 50%. In our prior example of 1000 hours, what you could say instead is that the work will probably take between 500 and 1500 hours. Another way to say the same thing is to say that you estimate the work at 1000 hours, plus or minus 50%. If there is a lot of uncertainty on the estimate, you may even give a margin of error of +/- (plus or minus) 100%. However, the purpose of providing the range is to help manage expectations. If you say that the estimated work is 1000 hours, which is probably the number you will be held to. Given the information you know, this could be a hard number to achieve. If you provide an estimate range, however, you will have a much better likelihood of delivering the work within the estimate, and you have a way to show the level of uncertainty in the numbers.

Accounting for Estimating Risks - Monte Carlo Modeling

One of the ways that you recognize uncertainty in your estimates is to add in a contingency factor. The contingency percentage is increased as we recognize more and more uncertainty in our understanding of what we are estimating. For most small and medium sized projects, adding a reasonable estimating contingency is perfectly fine, and should give you a final estimate that you can reasonably expect to achieve.

For larger projects, however, there are more powerful techniques available for recognizing the estimating risk. The most common is the Monte Carlo model. Monte Carlo modeling starts off a little like the PERT estimating technique. Rather than give one estimate for the duration of an activity, for instance, you provide a series of estimates that represent the best case, most likely case and the worst case. For each of these cases, you also assign a probability. For instance, there may be a 10% chance of hitting your best case estimate, a 80% chance of hitting your most likely estimate (or a 90% cumulative chance the activity will be completed (10% + 80%)) and an additional 10% chance of the work extending to hit the worst case scenario (or a 100% cumulative chance that the work will be done by the worst case estimate (10% + 80% + 10%)). You don't need to determine the percent likelihood for points in between - just those three points.

These three estimates are prepared for each activity in the workplan. When you are done, most workplan tools have a function to perform a Monte Carlo Simulation. Basically, the simulation models how the project will progress, and reaches an estimated end date. The project plan is then mapped out again, this time using differing probabilities, and therefore calculating a different end date. The reason the model is run many times is so that the risk percentages have a chance to play out. For instance, in our example above, if the simulation was run 100 times, you would expect that the activity would hit the best case 10 times (10%), the worst case 10 times (10%) and the expected case 80 times (80%). As the modeling tools randomly picks estimated values based on probabilities, many different project scenarios play out. However, a basic pattern starts to emerge that allows you to project the most likely date that your project will end. Looking for the threshold where the project ends 90% of the time usually does this.

Although the example above used schedule risk, you can also use this technique for providing better estimates for cost and effort as well. The good thing about the Monte Carlo Simulation is that if you provide activity estimates in ranges, most tools will perform all the statistical calculations automatically. You just have to make sure that you have provided valid and reasonable estimates for the activities. You can see that the extra work required in the estimating process makes this a model to be used for projects that are very large, or those that contain a lot of risk. Small and medium sized projects would probably not find value in this technique.

Validate an Old Estimate When a New Team is in Place

Sometimes a project team is formed to define the project, build the workplan, and then execute the project. However, sometimes the effort and duration of a project is estimated very early, perhaps because the information is needed as part of the yearly budget cycle. In these cases, a project team may be put together and asked to deliver based on the high-level estimates that are done earlier. If that happens, one of the first jobs of the new project team is to validate the estimates. You do not want to be in a position of having to deliver against someone else's estimates. On the other hand, if you do not validate the estimates early, then the expectation is being set that you think they are accurate. Challenge the estimates early. If you agree with them, fine. If you do not, now is the time to raise the red flag. You may find out that if your estimate is higher, the project cost / benefit no longer makes sense. Again, it is better to find that out earlier rather than later.

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Should You Include Customer Cost and Effort?

Some companies want to understand the total effort and cost of a project, including both the direct project team and the customer. Customer effort includes the time to review and approve deliverables, provide requirements, attend meetings, attend training, participate in training, etc. In other companies, the project costs only include the direct project team. So, whether you include customer hours and cost in your estimate is an area you should discuss with your manager and your Sponsor. If your project estimate include customer hours and cost, the hours need to be kept separately. Although the combined number provides a better overall estimate, the Project Manager normally is not responsible for the customer resources, and so should not be held accountable for achieving those particular targets.

Wishful Thinking Almost Always Will Get You in Trouble

Anyone who has provided estimates of work knows that there is pressure from your customer to make the estimate as low as possible. Ultimately, the customer wants to get what they need for as little effort as possible. In many cases, there is a tendency on the part of the estimator to get caught up in that mindset as well. Usually, it is because we think about what it would take to complete the work if everything went right. We may recognize the potential for problems, and the fear of the unknown. However, when we do an estimate, we take a mental shortcut of thinking that everything will go right. We might even think in terms of a range of effort for the work, but then too often we end up committing to an estimate at the lower end of the range. Even though we know better, almost every time we use wishful thinking in our estimates, it comes back to burn us. A better technique is to consider the estimate in terms of everything going right and everything going wrong and an average of the two, which might represent the most likely estimated time ($\text{estimate} = (\text{best case} + \text{most likely case} + \text{worst case})/3$). If you want to provide more weighting, use the PERT estimating technique of $(\text{worst case} + 4 * (\text{most likely case}) + \text{best case}) / 6$. Again, if you can provide the final estimate in terms of a range, you will be better able to manage expectations.

The Customer Says the Estimate is Too High

After you have prepared your estimate, you may need to defend it if the customer thinks that the numbers are too high. You should be able to first defend the estimate by explaining the estimating techniques you used, the process you followed, and the assumptions you made. If the customer still thinks the numbers are too high, or cannot afford the solution at that cost, there are a few more options.

1. Determine if the customer has any additional information that would allow you to revise your assumptions and perhaps revise the estimate. For instance, if a critical end date now has some flexibility, perhaps the estimate can be revised based on this new information.
2. Determine whether high-level requirements and functionality can be scaled back. In many cases, the original set of requirements is more of a wish list. After seeing a price tag, it is very possible that the customer can live without certain features.
3. (If applicable, depending on the project. If you included a high contingency to reflect a high estimating risk, ask the customer for more time to gather more detail for the estimate. This may result in there being less uncertainty and risk, and allow you to reflect this is a smaller contingency. Be careful you do not use this to do the full business requirements phase, as in the next option.)
4. (If applicable, depending on the project. Restructure the project to only include the detailed analysis phase. Then re-estimate the remainder of the project, based on a confirmation of exactly what is being requested.)

Creating an Estimating Packet

The next time you are asked to provide an estimate for a major piece of work, consider presenting a packet of information. This does not have to be a thick document. It is only meant to show the rigor that you went through. You should especially consider this if the work is political, or if you think that your estimate will not be accepted. Rather than just provide a final number, or number range, for your estimate, provide the following information instead.

- Your understanding of the work that was requested
- The process you used to prepare the estimate
- The estimating technique(s) you used
- The actual estimate of work effort (and duration and cost, if applicable)
- The detailed estimating information, in case the receiver would like to review. For instance, if you did a quick Work-Breakdown-Structure, you can include your detailed work estimates.
- The assumptions you made in developing the estimate

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- The level of uncertainty in the numbers, which is reflected in the contingency, or the size of the estimating range. (The wider the range the more uncertainty is reflected.)

This would be a powerful packet of information to return to the requestor. If there were disagreements with your estimate, this would give you the facts to respond. It will also stop many challenges, because people will have difficulty challenging your facts. You may get asked to change your estimating assumptions, or to try another estimating technique. These are legitimate requests and you can re-estimate based on new criteria. But at least the challenges are in terms of the estimating process, not on whether you did a poor job on the estimate itself.

2.3 Build the Workplan / Deliverables

Size	Information Needed
Small	<p>A small project requires some basic fields on the workplan. This workplan can be entered into a project management tool, a spreadsheet, paper, etc. The project status can be quickly gathered by reviewing estimated end date versus actual end date, and estimated effort hours versus actual effort hours.</p> <p style="text-align: center;">(1) Deliverable: Project Workplan</p> <p>Activity #: A sequential number. If nothing else, the activity number is used for showing the optional dependency information.</p> <p>Activity: The work to be performed, usually in 40 hours or less for a small service request. (Twenty hours or less is better.)</p> <p>Estimated Start Date: When should the work begin?</p> <p>Estimated End Date: When should the work end?</p> <p>Estimated Effort: What is the estimated effort for this activity?</p> <p>Estimated Cost (Optional): If tracking costs are necessary.</p> <p>Actual Start Date: When did the activity actually begin?</p> <p>Actual End Date: When did the work actually end?</p> <p>Actual Effort Hours (Optional): Update with the effort hours to complete if they are being tracked.</p> <p>Actual Cost (Optional): Update with actual costs if they are tracked.</p> <p>Resource(s): Who is assigned to do the work?</p> <p>Current Status: Usually 'Pending' / 'OnHold' / 'In Progress' / 'Complete'</p> <p>Dependency (Optional): Enter the activity number of the activity that must be completed before this one can start. In many cases, this is a level of sophistication not needed for small projects.</p>
Medium Large	<p>For medium and large projects, you really need to be using a project management tool. A tool will allow you to set up and track dozens of additional fields if you need to. Remember as well that the more information tracked the more complicated the updating process will be. However, the following information will certainly be needed.</p> <p style="text-align: center;">(1) Estimate of Work</p> <p>Overview: Describe your understanding of the work you are estimating.</p> <p>Process Used: Describe the process you used to do the estimate.</p> <p>Estimating Techniques: Describe the estimating techniques you use.</p> <p>Estimation Summary: The overall estimate in terms of effort hours, cost and duration.</p> <p>Estimating Details: Lay out the detailed estimate that you prepared. If this is very lengthy, the details can be included as an attachment.</p> <p>Estimating Assumptions: Any relevant assumptions that were made.</p> <p>Level of Uncertainty: Describe the level of uncertainty in the estimate, and the reasons for the uncertainty. Detail how this uncertainty was reflected in the estimating contingency. (Do not hide the contingency.)</p> <p style="text-align: center;">(2) Deliverable: Project Workplan</p> <p>Activity #: Should be generated by the tool. There will probably be options as to how this is represented.</p> <p>Activity: The work to be performed.</p> <p>Estimated Effort: The estimated hours to complete this activity.</p> <p>Estimated Start Date / Dependency: If the activity needs to start on a certain date, it is entered here. If the activity starts when another one(s) end, then the dependency is entered, and the tool automatically calculates the end date.</p> <p>Resource(s): Who is assigned to do the work?</p> <p>Percent Complete: Starts off at 0%, and ends at 100%. While the activity is in progress, it provides some indication of how much work has been completed and how much is remaining (see Managing the Workplan - Techniques).</p>

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	<p>Actual End Date: Calculates automatically when the activity is 100% complete.</p> <p>Actual Effort Hours (Optional): Update with actual effort hours if they are being tracked.</p> <p>Actual Cost (Optional): Update with actual costs if they are being tracked.</p> <p>Notes (Optional): Provides an area to document more information about a specific activity.</p> <p style="text-align: center;">(3) Deliverable: Associated Reports</p> <p>In addition to the workplan there may be additional information that needs to be shared through the many reports that can be generated from a project management tool. For instance, a list of assigned activities can be created for all team members and a high-level milestone status chart can be created for management and customers. Work with your team, your manager and your customers to determine which ones would provide the most value to them.</p>
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2.4 Build the Workplan / Additional Workplan Activities

The following table represents the project management activities listed from all ten steps in this methodology. This represents a large project, and would need to be customized for a smaller one or one where all ten steps were not fully executed. This is not a full workplan, only a sample set of activities, and any helpful notes. Depending on your project, you would need to add information on estimated start, estimated effort, actual effort hours, resources, etc. to make the Project Workplan complete. In most cases, the Project Manager is responsible for this work, unless specifically delegated.

Activity	Notes
Project Management Activities	
Plan the Project	
Define the work	
Gather preliminary baseline material	What information already exists that will help build the deliverable?
Gather input from customer and stakeholders	
Identify project risks and mitigation plans in Risk Management Plan	Could be an initial draft from Project Manager or a facilitated session with key stakeholders.
Create draft of Project Definition	
Circulate Project Definition draft to manager and team members	
Update Project Definition based on preliminary feedback	
Create Project Management Procedures	
Circulate Project Definition and Project Management Procedures to Sponsor and Stakeholders for feedback	
Make final updates to Project Definition and Project Management Procedures	
Send Project Definition and Project Management Procedures to Sponsor and the appropriate stakeholders for approval	
Build the Project Workplan	
Hold facilitated session with team members to lay out workplan and estimate the work	
Create draft of Project Workplan	
Balance hours and resources as necessary	
Validate work remains consistent with Project Definition , as the definition gets	

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revised	
Finalize Project Workplan	
Manage the Project	
Update the Project Workplan	
Manage issues	
Review status of outstanding issues	Weekly
Update Issues Log with current status	Weekly
(Resolve specific issues that arise during the week.)	Add activities identified to analyze and resolve issues
Update Project Definition , if necessary	If an issue causes a change to definition
Manage scope change	
Review status of outstanding scope change requests	Weekly
Update Scope Change Log with current status	Weekly
(Resolve specific scope change requests that arise during the week.)	Add activities to analyze and resolve scope change requests
Update Project Definition , if necessary	If a scope change causes a change to definition
Manage communication	
Build Communication Plan	See detailed notes in 'process' section for managing communication
Receive Status Reports from team members	Weekly / bi-weekly
Create Status Report for Sponsor and the stakeholders	Monthly
Attend Status Meeting with team members	Weekly / bi-weekly
Attend Status Meeting with customer and stakeholders	Weekly / bi-weekly (or monthly)
Execute Communication Plan	Add activities to execute the Communication Plan
Manage Risk	
Review status of Risk Management Plans for previously identified risks	Weekly / bi-weekly / monthly
Evaluate the project for new risks	Monthly, add activities identified to manage and mitigate risks
Manage Documents	
Design and build document repository	Software, tool or directory structure
Create document procedures and standards	Naming conventions, versioning, internal approval process, templates, etc.
Evaluate document management processes and update as necessary	Monthly
Manage Quality	

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Manage deliverable building process for quality	Add specific activities from the quality control and quality assurance processes
Evaluate metrics for process improvement opportunities	Monthly, add activities identified for process improvements
Manage Metrics	
Define appropriate metrics for the project	See detailed notes in 'process' section for managing metrics
Capture metrics	Monthly
Report metrics	Monthly
Evaluate metrics for continues relevance	Monthly, revise as appropriate
Project Related Activities	
Analysis Phase	Add activities here
Design Phase	Add activities here
Construct Phase (includes testing)	Add activities here
Implementation Phase	Add activities here

3.0 Manage the Workplan

If you have been following Steps 1 and 2, you have created a **Project Definition** and a **Project Workplan**. Some Project Managers think creating the workplan is the hard part. However, now you must manage the workplan, and ensure that it represents the current status of the project. Just as important, the workplan should always give a good representation of how much work is remaining.

3.1 Manage the Workplan / Process

3.2 Manage the Workplan / Techniques

3.3 Manage the Workplan / Deliverables

3.4 Manage the Workplan / Additional 'Build Workplan' Activities

3.1 Manage the Workplan / Process

Small Projects

1. Review the workplan on a weekly basis.
2. Identify activities that have been completed during the previous week and update the workplan to show they are finished.
3. Determine whether there are any other activities that should be completed, but are not. Work with the individual(s) who are assigned to see what is going on. There could be problems that need to be resolved, or it may be that the length of time needed to complete the activity was underestimated. Determine how much additional effort and duration will be needed to complete the work and update the workplan accordingly.
4. Evaluate the remaining work to see if the project will be completed within the original effort, cost and duration. Even though some activities may be completed later than planned, other work may be completing early.

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5. Adjust the workplan so that it reflects how the remaining work will be completed. The first priority should be to complete the project within the original estimates for effort, duration and cost.
6. If any of the original estimates cannot be met, new estimates need to be prepared and communicated to management and to the customer. This is important information to share because there may be areas where they can provide input. For instance, the customer may agree to reduce the remaining requirements to allow the project to complete within the original estimates.

Medium and Large Projects

Review the process associated with small projects. Although a small project may have twenty activities and a large project many have five thousand, they both end up using a similar process. However, there is more rigor that is put in place for larger and larger projects. In the case of larger projects, there may be a person(s) responsible for actually updating the **Project Workplan** with actual results, and then running reports that are presented to the Project Manager for evaluation and analysis.

1. Review the workplan on a regular basis. For a medium project, this is probably still a weekly process. For larger projects the frequency might be every two weeks. Do not go any less frequently than every two weeks. (A frequency of monthly is too long. There is too much work taking place, and if there are problems, too much time may pass before they are surfaced.)
2. If the project is capturing actual effort hours and costs, update the workplan with this information. Identify activities that have been completed during the previous time period and update the workplan to show they are finished. The effort hours and status can come from team members through the **Status Reports** and status meetings (Manage Communication). In some cases, the tool might be set up so that team members can update the workplan directly with their effort hours and completion status.
3. Determine whether there are any other activities that should be completed, but are not. This information can be gathered by running the appropriate report from the project management tool. Work with the individual(s) who are assigned to see what is going on. There could be problems that need to be resolved, or it may be that the length of time needed to complete the activity was underestimated. Determine how much additional effort and duration will be needed to complete the work and update the workplan accordingly.
4. After the workplan has been updated to show the current reality, let the tool reschedule the work to see if the project will be completed within the original effort, cost and duration. Even though some activities may be completed later than planned, other work may be completing early.
5. Run additional reports from the project management tool to help determine how the project is progressing. For instance, look at resource allocation. The project may be completing on schedule because some of the team member are being scheduled for 80 hours per week. If you saved a baseline version of the workplan, you can run reports to compare the current workplan against the baseline to see the variances.
6. Look at your budget. (Because of how financial reporting is done, you may need to manage the budget on a monthly basis, even if you update the workplan on a weekly or bi-weekly basis.) If you are keeping all of your expenditures in your project management tool, this may be as simple as running a report to compare actual expenditures against budgeted expenditures. More than likely, however, you are keeping up with your budget on a separate spreadsheet. Update the tool to reflect all expenditures paid to date, including all expenses related to labor, equipment and material.

Then compare the numbers against your budget. There are a number of items to factor in to this comparison.

- Some expenses may be budgeted for, but in another period. If you paid for a major purchase this period that was originally scheduled for next period, then it shouldn't surprise you to see that you are technically 'over budget'. This type of expense will be a wash over time.
- You may not be over budget if you are also ahead of schedule. If your project is on schedule, but over budget, there may be a problem. However, if your project is ahead of schedule, it may be fine that you are also ahead of your budget. For instance, you may have paid contractor overtime to get ahead of schedule, or utilized more employee labor hours to get ahead of schedule. In this case, creating your estimate-to-complete should show that the project would complete within its allocated budget.
- The project may be on schedule but over budget because some of the activities are taking more effort than estimated. This could be because of working unscheduled overtime or applying more resources than

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estimated. In this case, if the trend continues, the project budget may be in jeopardy. This should be raised as a budget risk unless there are mitigating factors that will allow the over budget trend to reverse.

- It's very possible that mandatory activities or project expenses were missed when the original estimates were put together. If the work or expense is required, but missed in the estimating process, you may not be able to invoke scope change management. In this case, a budget risk should be raised unless there are mitigating factors that will allow you to recoup the additional expense through a cost savings somewhere else.
- Is an over budget situation caused by doing work that is outside the approved Project Definition or business requirements? If so, the work should stop until scope change management can be invoked. Even if the over budget can be recouped somewhere else by cost savings, scope change requests should not be allowed to impact the project unless they were approved, along with the corresponding approval of revised budget and delivery timeframe, if necessary.

If you find that you are, in fact, trending over budget read 3.2 Manage the Workplan / Techniques for techniques to get back within budget.

7. Look for other signs that the project may be in trouble. These could include

- Activities starting to trend over budget or behind schedule early on in the project. There is a tendency to think you can make it up, but usually these are a warning that you will get further in further in trouble.
- A small variance starts to get bigger, especially early in the project.
- You discover that activities you think have already been completed are still being worked on.
- You need to rely on unscheduled overtime to hit the deadlines, especially early in the project.
- Team morale starts to decline
- Deliverable quality or service quality starts to deteriorate.
- Quality control steps, testing activities and project management time starts to be cut back from the original schedule.

If these situations start to occur, raise visibility through risk management. Put together a Risk Management Plan to proactively ensure that the project stays on track. If you cannot successfully manage through the problems, raise an issue. (See 3.2 Manage the Workplan / Techniques section for ideas to get an over budget / behind schedule project back on track.)

8. Evaluate the critical path of the project. The critical path is the sequence of activities that must be completed on time for the entire project to be completed on schedule. (For more information on critical path, read 3.1.1 Manage the Workplan / Critical Path.) If the end date has slipped, it will be because at least one activity on the critical path did not completed on time. It is important to understand the critical path sequence to know what activities need to be accelerated for the project to complete earlier. Placing additional resources on non-critical activities will not result in the project completing earlier. It is also very possible for the critical path to change on the project. Again, you may be trying to accelerate activities that were on the critical path, but if the critical path changed, this will not have the intended result.
9. Adjust the workplan so that it reflects the how the remaining work will be completed. The first priority should be to complete the project within the original estimates for effort, duration and cost.
10. If any of the original estimates cannot be met, new estimates need to be prepared and communicated to your management and to the customer. This is important information to share because there may be areas where they can provide input. For instance, the customer may agree to reduce the remaining requirements to allow the project to complete within the original estimates.
11. On a monthly basis, adjust future work to reflect any additional information, or additional detail you know now. For instance, when the workplan was created, many of the later activities may have been vague, and placed on the workplan at a high level. On a monthly basis, this work needs to be defined in greater detail. For sure, work hat covers the next three-month window should be scheduled out in activities of not more than 80 hours. If work is entering this three-month window at a higher level, then break it down into a lower level of detail. Note that this step refers to originally identified work that requires more detailed information. This is not the place to add new work. That is done through 5.0 Manage Scope.

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3.1.1 Manage the Workplan / Critical Path

Critical path refers to the sequence of activities that must be completed on schedule for the entire project to be completed on schedule. In other words, if the end date for the project has slipped, it is because at least one activity on the critical path did not complete on time. It is important to understand the critical path sequence to know where you have flexibility and where you do not. For instance, you may have a whole series of activities that end up running late, yet the overall project will still complete on time. On the other hand, if your project is falling behind, placing additional resources on non-critical activities will not result in the overall project completing earlier.

The Logic Behind Critical Path

There are a number of ways to manually calculate the critical path of your project. The visual representation of the critical path is easy to follow, but laying out the pictures and an example would require more graphics than what makes sense for this web page. However, from a logical point of view, you can think about it as follows.

On every project, no matter how complicated, there are always some activities that can be started earlier or completed later without jeopardizing the final completion date for the project. This flexibility between the earliest time an activity CAN be completed and the latest time when it MUST be completed is called float. There is similar float if the activity has flexibility between the earliest time it CAN start and the latest time it MUST start. By definition, if an activity has flexibility, or float, associated with its start and end date, then it is NOT on the critical path.

Now let's look at those activities where you do not have the flexibility in the start and end dates. These activities cannot be completed earlier because they are pending the completion of another activity. They also cannot be completed later than scheduled without causing all the succeeding activities to be late. That's because none of the activities that follow have any flexibility, or float, in their start and end date. All of these activities back up tightly against other activities that precede or succeed them. The critical path consists of the longest sequence of activities that must be started and completed as scheduled, or else the entire project will be delayed. In other words, it is the longest sequence of activities with zero float. If any activity on the critical path is late, the entire project will be late (unless the time can be made up somewhere else on the critical path).

The project end date is what it is because of the critical path. If there were not a critical path, then there would be at least some float in all the activity paths from start to finish. If there were float everywhere, then why wouldn't you squeeze the float out and finish the project earlier? The answer is that you would. As you moved the end date in to finish earlier, you would start to remove some of the float. However, at some point, the float would be gone from one of the paths. This would be a point where each activity on the path would have start and end dates that back up one against the other. There would be no more float on this sequence of activities. This would be the critical path.

For an example, say you have a project that is nine months long. After scheduling the work, your project management tool identifies the critical path. Let's assume that there are 22 activities in the critical path, all of various duration's and effort hrs. The second activity on the critical path was estimated to be completed in 8 days. As the project is proceeding, it turns out that this activity actually took nine days to complete. What you will find is that now the entire project will take nine months and one day. Delaying the completion of the second activity by one day made the schedule for the entire project go over by one day. Unless that extra day can be made up somewhere down the road the project will be completed a day late.

Why is the Critical Path Important?

Frankly, on many projects it is not necessary to determine the critical path. However, if you are trying to accelerate the overall schedule (in other words you are trying to complete the project earlier than currently scheduled) it is very important to identify these critical path activities. Remember that the critical path is where the activities are backed up one against the other with no float. Therefore, unless you are able to accelerate activities on the critical path, the end date for the entire project will remain the same. Applying additional resources to activities that are not on the critical path may allow them to be completed early, but they don't effect the overall project end date.

The Critical Path May Change

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There are many sequences of activities on a project to get from the beginning to the end. There may, in fact, be multiple critical paths, if they all have no float and all lead to the same end date. Usually if there are multiple critical paths, they overlap for many of their activities

Given that there are many, many paths through the workplan, it's possible for the critical path to change. For instance, say we have the same example as above, with 22 activities over nine months. Let's assume that there is another path of work that includes 19 activities and takes 8 1/2 months. If you tried to accelerate the schedule to complete the project in eight months, it gets a little complicated. First you would want to focus on accelerating the activities in the nine-month critical path. However, once the critical path is reduced to 8 1/2 months, another critical path emerges that has the same overall timeline. Compressing the original critical path further will not make the project end earlier, because this second path is still going to take 8 1/2 months to complete. In this case, both paths must be accelerated. (Or perhaps some activities that are common to both can be accelerated.)

The other way the path may change is if activities off the critical path get delayed. In the example above, let's say that one of the activities on the 8 1/2 month path ends up taking an extra three weeks. Because there was only two weeks of float in the path, it will now become the critical path, and force the entire project to complete one week late.

Calculating the Critical Path

There is a manual method for calculating the critical path by looking at the earliest start and end dates for every activity starting at the beginning of a project. You then start at the end of the project and go backward, looking at the latest possible start and end dates. The difference between the latest start day and the earliest start day is the activity float. (This will end up being the same as the difference between the latest end day and the earliest end day.) Now look for the sequence of activities from start to end that have zero float. This is the critical path.

Fortunately, all project management software packages will calculate the critical path for you. All medium to large projects need to use a tool to manage the workplan. Take advantage of this automatic feature. For a small project, there may only be one major sequence of activities, and it should be easy to identify.

Free Float, Path Float and Total Float

When you are looking at the float in your project, you may come upon three terms - free float, path float and total float. Free float is a term that is applied to individual activities. It refers to the amount of float in an activity before it delays the next activity. If activity B can start up to five days after activity A completes, without impacting the next activity, then activity B has a free float of five.

There is also a concept of path float, which is similar to free float, but is applied over an entire path of the workplan. Path float is shared by all the activities on the path. If one activity uses up some of its free float, it is also reducing the path float that is available for other activities as well. For example, if you have three activities - A, B, C - each with five days of free float, the path float is 15 days (5 + 5 + 5). If activity A starts on time and completes on time, then activity B now has ten days of free float and the path float is still 15. However, if activity A is delayed by five days, it can still finish on time, and activity B can still start on time. However, the path float has now been reduced by five days, leaving a path float of ten days remaining.

Total float refers to the total amount of float between all activities on all paths. If you have a lot of total float, then you usually have many more options as to how you allocate resources to achieve your due dates, and you have more flexibility if your project gets behind schedule. However, if total float on the project is low, that means you have more schedule risk, and much less flexibility. If the project starts to fall behind, you have a harder time reallocating resources, since if another path gets delayed, it may quickly turn into the critical path.

3.2 Manage the Workplan / Techniques

Techniques to Get a Project Back on Schedule

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Just because you monitor your project on an ongoing basis does not mean that you may never miss deadlines. The good thing about managing the workplan is that you will know very quickly if you are trending over the end date. This will give you an opportunity to put a proactive plan in place to get back on schedule. There is not a simple process that will do the trick in every case. However, there are some techniques you can apply to get the job done.

- **Overtime work.** Can team members work (more) overtime to make up the shortfall? This may have cost consequences, but may allow you to get the project back on schedule.
- **Reallocate resources onto the critical path.** First determine what work is on the critical path of the project. Then see if there are resources that can be moved from other activities to help with the work on the critical path. This will allow you to get the project back on track by delaying or stretching out some work that can safely be delayed. Be careful though - delaying some work may end up changing the critical path.
- **Double-check all dependencies.** It is possible that the scheduled is being lengthened by dependencies between activities that are not valid. Invalid dependencies may make it appear that activities must be performed sequentially, when they can really be done in parallel. Sometimes the scheduling software accidentally adds a dependency. Sometimes the Project Manager added the dependency, but upon later review decides that the dependency does not really exist. It might make sense to have the team members review the schedule to see if they find dependencies that the Project Manager thinks are valid, but that they know to be invalid. Before you get into more drastic measures to bring the project back on schedule, make sure that your facts are correct.
- **Check time-constrained activities.** Time constrained activities are those that have durations that do not change based on the number of resources applied. (For instance, you may be allocating team members to a five-day class. The class takes five days if one person attends, and it takes five days if ten people attend.) All of these time-constrained activities should be checked to validate the timeframe. Perhaps there are assumptions being made that could be changed with a different approach. For instance, if you allocated three days for a contract to reach a customer, perhaps the length could be reduced to one day by paying more for overnight delivery. If you have a two-day wait for concrete to dry, perhaps renting fans to blow air on the concrete could shorten the time.
- **Swap resources.** Does a team member(s) who is less productive than others cause the project delay? Or does not have the right skill set? There may be opportunities to replace resources, or swap them within a project team so that a more productive resource works on the critical path.
- **Improve processes.** There may be delays caused by inefficient internal processes. Get team member feedback and look for ways that are within your team's internal control to streamline processes. If there are delays caused by external processes, try to negotiate changes to the processes on a going forward, or at least a temporary basis.
- **"Crash" the Schedule.** Crashing the schedule means to apply additional resources to the critical path, in a way that minimizes the incremental costs. For instance, if one person were assigned to complete an activity in ten days, would two people be able to complete it earlier - perhaps not in five days, but earlier than ten days? The additional resources may come from within the project team, or they may be loaned temporarily from outside the team. Note that one of the goals is to minimize the extra cost. However, in exchange for completing some work ahead of schedule, crashing usually always leads to some additional incremental cost to the project.
- **Fast Track.** This involves looking at activities that are normally done in sequence, and assigning them totally or partially in parallel. For instance, a concrete foundation normally cannot be laid until the wooden frames are up. However, as a part of fast tracking, can the concrete be poured on one side of the foundation while the other half is still being framed? If so, then parts of these two activities can be done in parallel. Note that this technique can accelerate the schedule, but it almost always leads to more rework in subsequent activities, as all the details of the preceding activity become known to the succeeding activity. Therefore, there are almost always some incremental costs to the project.
- **"Zero Tolerance" scope change.** Work with the customer and team members to ensure that absolutely no unplanned work is being requested or worked on, even if it is just one hour. All energy should go into accelerating the core work that was agreed to.
- **Regain commitments.** Work with team members to evaluate future work, re-validate estimates, and gain commitments to complete work on schedule. Refocus the team on meeting deadlines.
- **Improve morale.** Build shared purpose, increase camaraderie, do some fun things. The team will work harder and perform better if they do not spend time complaining and sulking. Get people excited and happy again.
- **Scope back work.** If the completion date is firm (time boxed) and you cannot get the remaining work completed by the deadline date, then raise the situation as an issue. If no other options are found, work with the customer to reduce the scope and deliver less by the due date. This will first require issues management, and then scope change

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management. Update the **Project Definition**, if necessary, and replan the project based on the new remaining workload.

Techniques to Get a Project Back on Budget

Just as the Project Manager may face scheduling difficulties, you may also find yourself trending over budget. If you monitor costs regularly, you should know very quickly if you are trending over your budget. This control process is somewhat more difficult than managing the schedule, because there could be a variety of reasons why your financial information is not as good or as accurate. With scheduling, you know right away if you missed an end date. With the budget, you may not always know. First of all, you rarely spend money at a constant rate. So, you need to understand what you expected to spend during the period, as well as what you actually spent. In most companies, financial information comes in on a lag. For instance, you might not know the financial status for the previous month until second week of the current month. You may not recognize some expenses until you receive an invoice. In other cases, you may not have the expense hit the books until you pay an invoice, which may be much later. If your company uses purchase orders, your project may actually get hit with a project charge when the purchase order is generated, even if the actual invoice is not paid for weeks later. Depending on your budget, this may cause expenses to hit early, and may make it appear that you are trending over budget, when really you are not. (The expenses are just hitting your budget earlier than you had planned.)

In any case, although you may not always have the financial information at the optimum time, there are a number of techniques you can apply to try to rein in spending to get back within your budget.

- **Unpaid overtime work.** This option takes advantage of the situation where your employee staff does not get paid for overtime. It is usually the first place to look, and a team will rally around overtime to get a project back on budget. This is usually not a good solution for very long.
- **Swap human resources.** It may be possible to swap highly paid resources with ones that can do the work, but at a lower cost. In fact, if cost containment is more important than scheduled, you may also be willing for the work to take a longer time, if it ultimately can be completed successfully at a reduced cost.
- **Eliminate or replace non-labor costs.** Just as with people, it may be possible to utilize less costly materials, supplies or services than what was originally budgeted. For instance, can travelers stay at a discount hotel chain instead of more luxurious accommodations? Can team members utilize existing upgraded hardware instead of new machines? Can computer-based training, or team mentoring, be utilized instead of formal training? Can one person travel to the customer's location instead of two or three? In each of these cases, you are attempting to satisfy the original need, but by using a less-costly alternative.
- **Improve processes.** There may be cost overruns caused by inefficient internal processes. Get team member feedback and look for ways that are within your team's internal control to streamline processes. If there are cost implications caused by external processes, try to negotiate changes to the processes on a going forward, or at least a temporary basis.
- **"Zero Tolerance" scope change.** Work with the customer and team members to ensure that absolutely no unplanned work is being requested or worked on, even if it is just one hour. All energy should go into completing the core work that was agreed to. All approved changes to scope must also contain incremental budget.
- **Regain commitments.** Work with team members to evaluate future work, re-validate estimates, and gain commitments to complete the remaining work within budget.
- **Use budget contingency.** If the project is trending over budget because of underestimating some of the work, start to dip into your estimating contingency, if you have one. .
- **Scope back work.** If the budget is firm and you cannot get the remaining work completed within the budget, then raise the situation as an issue. If no other options are found, work with the customer to reduce the scope and deliver less within the original budget. This will first require issues management, and then scope change management. Update the **Project Definition**, if necessary, and replan the project based on the new remaining workload.

Make Sure Team Members Know What Their Assignments Are

One of the basic responsibilities of the Project Manager is to assign work to team members. However, some Project Managers are not always clear on what needs to be done and who is responsible. This causes uncertainty in the team, and can result of some activities running late. In fact, if you have managed projects for a while, you have probably run into this situation. You ask a team member the status of a critical assignment and they tell you that they did not realize that they were assigned to the activity. A good way to test whether your directions and assignments are clear is to ask team members what they are responsible for completing in the next two weeks. This is not something you need to do with every team member every week. However, it can be valuable to ask once in a while, or when a critical activity is due, just to validate whether you are assigning

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he work effectively. If the team members know what is expected of them, chances are that you are effectively assigning the world. However, if they give you different answers than what you expect, it may mean that you need to work on being clearer and more precise.

Team members need to be clear on what they are assigned and when the work is due. If they understand the work perfectly, but don't deliver on time, you have a problem. If they deliver the wrong work to you, on time, you also have a problem. When you assign work to team members, be clear about the following:

- **Activity name(s)**, from the workplan.
- **An explanation**, if necessary, of what the work is.
- **Start date and end date**. If they cannot meet the dates, they need to let the Project Manager know as soon as possible.
- **Estimated effort hours**. If they cannot complete the activities within the estimated effort hours, they need to let the Project Manager know as soon as possible.
- **Estimated costs**. If they cannot complete the work within the cost estimate, they need to let the Project Manager know as soon as possible.
- **Deliverable**. The team member needs to understand the deliverable or work component (a portion of a larger deliverable) that is expected.
- **Dependencies**. Make sure the team member knows their relationship with other activities, either ones that are waiting on them, or ones that must be complete before theirs can start.
- **Other resources**. If multiple resources are working on the same activities, they must all understand who is responsible for what, and who has overall responsibility for each activity.

Tolerances

When you manage the workplan, you do not want to be accurate to the minute or to the dollar. You also do not want to make a big deal if your project is a day over deadline one week, and a day ahead of schedule the next. Your customer does not expect that level of accuracy, and they are not interested in an hour-by-hour account of how the project is progressing. As the project manager, you should have some sense for what the tolerance level is for your project. For example, let's say you are updating your workplan and you realize you have overspent your budget by \$1,000. Should you raise an issue or a risk? Should you inform your customer? It depends on your tolerance level. If you have a \$10,000 budget, you should probably be concerned, because now you are at risk of going over budget by 10%. If your project has a one million dollar budget, then the thousand dollars is not material at all. (In fact you would be a hero if you delivered within one thousand dollars.)

Use common sense and work with your customer on the tolerance levels for budget and deadline. If you stay within the tolerances, then you are fine. If you go outside those limits, then you should be concerned.

Earned Value

Projects, especially larger ones, are never executed exactly as they are planned. Some activities finish early. Some finish late. Sometimes it is not easy to know if you are ahead of schedule or not. Sometimes it is hard to know if you are under budget or not. Let's look at a simple example. You have a six-month project and you have completed three months. Your workplan says that you should have spent 50% of your budget, but you realize you have already spent 65% of the budget. Are you in trouble? You could be, but not necessarily. If you only have half of the work done, you might be in trouble. But what if you are actually ahead of schedule? If you were ahead of schedule, would it make sense that you might be over budget at this point in the project? If you were 90% done with the work, and your budget was at 65% of total, you actually are in pretty good shape. This is the purpose of earned value calculations. Earned value is a method for determining the progress of a project, given where you are versus where you expected to be. To learn more about earned value, 3.2.2 Manage the Workplan / Earned Value.

Team Resistance to Managing the Workplan

It's one thing to build a project definition and the workplan. It's another thing to effectively manage the project. If you could issue the plan and the work assignments and have everyone complete their activities on time, the Project Manager's life would be much easier. However, the process of managing the team and the workplan becomes complicated because of the people element involved. To understand how the project is proceeding and to ensure that it stays on track, controls are needed. You may need to go around and ask people how they are doing. You may need people to tell you in status reports and status meeting how they are doing. You may try to keep updated statistics on work completed, in-progress and not started. These activities make up your overall project management processes. However, people do not always respond well to these processes for a number of reasons.

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- They may think the processes are cumbersome and keep them from completing their deliverables
- They may feel they will be punished for bring bad news, or doing things incorrectly
- They may not feel the project management processes are effective
- They may have a normal human tendency against processes that feel like controls
- The processes may not be complete or make sense. They may have tried to follow one, but found it was not complete, or was not supported by others.
- They may feel that the Project Manager is not following the procedures.
- They may see people going around the processes without consequences

Knowing and recognizing these normal human tendencies will help design a set project management processes that are appropriate to the project being managed. It also points out the need to communicate the processes effectively, including the overall value to the project. Once discussed with the team, it is important to apply the processes consistently for them to be adopted successfully on the project.

Who Updates the Workplan?

In most projects the Project Manager is responsible for the workplan and updates it on a weekly or bi-weekly basis. In most projects the Project Manager is the only one that is allowed to update the plan. However, there are some options, especially for larger projects.

In some cases, the Project Manager asks each team member to update the workplan with a current status and effort hours (if they are being tracked). In this scenario, the team members normally indicate whether their assigned work is completed. If not, they identify what percentage of the activity is complete, or adjust the end date to reflect when the activity will be complete. They can also plug in their actual effort hours per activity so far. In most cases, team members are not allowed to assign themselves to new work, add new activities or otherwise alter the workplan. After the team members update the plan with current status, the Project Manager can begin to evaluate the overall project status.

For very large projects, it is also common for one or more people to be assigned to update the workplan on behalf of the Project Manager. They can get information from team members and update current status and actual hours worked. They can run a standard set of reports for the Project Manager and get additional information from team member for anything that looks unusual. They bring this all to the Project Manager for final analysis and evaluation. The bottom line is that the additional staff performs much of the logistics associated with the workplan, but it is still the responsibility of the Project Manager to understand what is going on, and makes the appropriate decisions to complete the project successfully

Proceed with Caution if Managing by Percent Complete

Most project management tools have an available field for entering the percentage complete for each activity. Before an activity starts, it is 0% complete. When it is finished, it is 100% complete. However, in between can be tricky. On the surface, if an activity is estimated at 40 hours, and a team member had worked on it for 20 hours, you could say they are 50% complete. But are they? They may be close to done, or they may be only 10% done. The Project Manager could ask team members to report on their percent complete, but in many cases you fall into the 99% complete syndrome. This occurs when an activity is 90% done one week, the next week it is 95% done, the next week 99% done, etc.

A better way to get the information you need is to ask 'When will the work be done?' So, if the schedule shows an activity to be completed on Friday, and the work is not done, don't ask what percentage complete they are. Instead ask the team member 'When will the work be done?' Asking when the work will be completed gives you concrete information you can place on your workplan, while also getting the team member to make another commitment to the end date.

Managing by Due Date

In many organizations, project estimates are based on costs, effort hours and duration. However, when the project starts they do not collect the actual effort hours worked on each activity. Unless tracking effort hours is important to your organization, the Project Manager should feel comfortable to manage the project schedule based on completion dates. In other words, assume you have an activity that is scheduled to take 40 hours and have a two-week duration. If the work is done within the two weeks, it is not as important to know if the work actually took 35 hours or 50. It would only be important if the difference in effort hours caused another activity due date to be missed. The effort hours are important in the estimating process since they help set

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completion dates and help balance workloads. But when the activities are assigned, getting the work done on time is most important.

There is one important exception. If the work is being done by a resource that you are compensating on an hourly basis, it is important to manage by effort hours and completion date. Now it does matter whether the 40-hour activity actually took 50 hours, since there is an incremental cost to your project.

Managing by Milestones

A milestone is a scheduling event that signifies the completion of a major deliverable or a set of related deliverables. A milestone, by definition, has duration of zero and no effort. Milestones are great for Project Managers because they provide an opportunity to validate where the project is and what the future looks like. In particular, you can do the following activities:

- Update the workplan and validate where you are trending in terms of overall project budget and deadline.
- Validate that work done up to this point is correct and accurate. The customer should have approved any external deliverables produced up to this point.
- Make sure that the rest of the project workplan includes all the activities necessary to complete the project.
- Double-check the effort, duration and cost estimates for the remaining work. Based on prior work completed to-date, you may have a much better feel for whether the remaining estimates are accurate. If they are not, you will need to modify the workplan. If it appears that your budget or deadline will not be met, raise an issue and resolve the problems now.
- Issue formal communication and status, per the communication plan.
- Evaluate the Risk Plan for previously identified risks, and perform a new risk assessment to identify new risks.
- Update all other project management logs and reports.

These activities should be done on a regular basis, but a milestone date is a good time to catch up, validate where you are at, get clear on what's next and get prepared to charge ahead.

The Project Audit

Sometimes the Project Manager can get too comfortable (or too uncomfortable) in how the project is progressing. In many cases, it makes sense to have an outside party come in to evaluate the project management processes being employed and provide a double-check to make sure the project is progressing as expected. . The Project Manager or functional manager might call for a project audit as part of an overall quality management program. In some cases, such as a government project, periodic audits may be called for as a part of the overall contract. In any event, an outside audit should provide comfort to the project stakeholders that effective project management processes are being utilized.

When 'Completed' Activities Are Not Really Completed

Sometimes a team member says that an activity is complete - when in reality it is not quite. This can happen if the activity should have been completed yesterday, and the team member believes they are just an hour away from completing it. They might rather say it is complete and then finish it up, rather than deal with the consequences of it being late. Usually this is not a big deal. Sometimes, however, activities start to slip because the team member did not start it on time - because they were finishing up a prior 'completed' activity. Sometimes this can also be caused by deliverables that are completed but not approved. The team member may say the work is complete, but when the deliverable is checked it is discovered it is incomplete or needs additional follow-up work. To avoid this, make sure that there is an approval process for all major deliverables, and that the workplan leaves time for the approval process and for rework based on feedback. Then there is no question that the deliverable is completed, because it has either been approved or it hasn't. If an activity does not call for the completion of a deliverable, you would expect that if a team member says an activity is completed, that it probably is. If you find a pattern of this not being the case, then the individual team member might need coaching on how to better report the status of their work.

Action Items

This is probably as good a place as any to discuss action items. After all, action items are nothing more than work that need to be done to complete an activity, answer an outstanding question, etc. One technique to ensure that action items are completed is to place them in the workplan. For further information, click over to 3.2.1 Manage Action Items.

3.2.1 Manage the Workplan / Action Items

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An action item is work that requires follow-up execution. By their nature, action items normally cannot be planned for in advance. They arise on an ad-hoc basis during meetings or as a by-product of working on something else. An action item is assigned because there is not enough knowledge, expertise or time to resolve the item at the time. In many cases, action items are administrative in nature, but in other cases they can require substantial work to complete. They are not significant enough to require alterations to the **Project Definition**, however they need to be followed up on and completed. (If they are not going to be completed, they should not be called action items. Instead, simply note that the item will not be followed up on.) Examples of action items include forwarding specific information to someone, arranging a meeting and providing a quick estimate on a piece of work, etc.

Sometimes an action item is established to investigate an area where there may be a potential problem. Because of this, action items are sometimes mixed in with issues. However, this is not right. An action item should not be confused with an issue. An issue is a problem that will have a detrimental impact on the project if left unresolved. An action item may lead to the discovery of an issue or a risk (a potential issue in the future), but the action item itself is not an issue.

There are two common approaches used to manage action items. The best approach is to document the items as activities on the project workplan. A resource and end date is assigned as well, and the activity is then managed and tracked as normal. In general, this is the better approach to follow, because it keeps the work items in one place, and allows the Project Manager to enforce the discipline of 'if it's not on the workplan, it will not be worked on.'

However, another popular approach is to track and manage action items on a separate Action Item Log. If you use this approach, action items can be identified, documented, assigned and resolved using the following process:

1. Action items may be identified by anyone on the project team. They often arise out of interactions between and among project team members, particularly at status meetings.
2. The Project Manager or a designated person enters the action item in the Action Item Log. This records its existence to ensure that it receives attention and is carried out.
3. The Project Manager or designated person assigns the action item to a team member, who assumes responsibility for the action item and takes the necessary steps to complete it. A quick estimate of effort should be agreed to and added to the log.
4. A date for the completion of each action item should be entered in the log.
5. If completing an action item involves more work than anticipated, it should be brought to the attention of the Project Manager.
6. The Action Item Log should be reviewed at regular intervals during project team meetings to ensure that action items have been completed successfully.

Action items are normally time sensitive. If an action item has not been completed in a reasonable timeframe, it should be eliminated.

The Project Manager (or designated person) must follow-up to ensure that action items are closed. In general, if they are not assigned to a specific person, have no target date or are not followed-up, there is a good likelihood that the action item will not be completed. If they are not going to be completed, there is no use in documenting and tracking them at all.

3.2.2 Manage the Workplan / Earned Value

Earned value is a set of techniques that were first used in the 1960's in the Department of Defense to objectively measure the status of a project in terms of budget and schedule. The concepts are interesting and have value for all Projects Managers. However, from a practical standpoint, very few companies and projects utilize earned value. It is a concept worth knowing, but probably not one worth applying to your project unless your entire organization chooses to track progress this way.

The topic of earned value can be the subject of a one-day class. The purpose of this page is to provide an overview of the concepts. There are many websites and white papers that can be reviewed to find more information on this subject.

Budgeted Cost of Work Performed (BCWP). This term is also referred to as the Earned Value. The BCWP is calculated by adding up the budgeted cost of every activity that has been completed. If an activity is in progress, you can give it zero value.

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until it is completed, 50%, or the full amount. Just be sure you are consistent with whatever rule you choose for in-progress work.

BCWP is the basic measure of how much value the project has achieved so far. By itself, it does not tell you too much. So, we use it in combination with other calculations to determine your budget status.

Actual Cost of Work Performed (ACWP). To calculate this number, add up the actual cost for all the work that has been completed so far on the project.

Budgeted Cost of Work Scheduled (BCWS). This is the sum of all the budgeted estimates for all the work that was scheduled to be completed by today (or by any specific date).

Schedule Variance (SV). This is the BCWP - BCWS. It tells you whether you are ahead of schedule or behind schedule. If the result is positive, it means that you have performed more work than what was initially scheduled at this point. In other words, the budgeted cost of the work scheduled at this time is less than the budgeted cost of the work actually performed. Likewise, if the SV is negative, the project is probably behind schedule.

Cost Variance (CV). This is the BCWP - ACWP. This gives you a sense for how you are doing against the budget. If this CV is positive, it means that the budgeted cost to perform the work was more than what was actually spent for the same amount of work. This means that you are fine from a budget perspective. If the CV is negative, you may be over budget at this point.

Schedule Performance Index (SPI). This is a ratio calculated by taking the BCWP / BCWS. This shows the relationship between the budgeted cost of the work that was actually performed and the cost of the work that was scheduled to be completed at this same time. It gives the run rate for the project. If the calculation is greater than 1.0, the project is ahead schedule. For instance, if the SPI is 1.1, it means that your project has completed approximately 10% more work than what was scheduled. If that trend continues, you will end up taking 10% less time to complete the project than what was scheduled.

Cost Performance Index (CPI). This is the ratio of taking the BCWP / ACWP. This shows the relationship between the budgeted cost of work performed and the actual cost of the work that was performed. It gives the burn rate for the project. If the calculation is less than 1.0, the project is over budget. For instance, a CPI of .90 means that for every ninety dollars of budgeted expenses, your project is spending \$100 to get the same work done. If that trend continues, you will end up 10% over budget when the project is completed.

Budget at Completion (BAC). This calculation can be in terms of dollars or hours. It is the ACWP, added to the budgeted cost of the remaining work. If the CPI is not close to 1.0, then the budgeted cost of the remaining work must be factored to take into account the historical burn rate. So, if the CPI is not 1.0, then the BAC is the ACWP + (Budgeted Cost of Work Remaining / CPI).

Estimate to Complete (ETC). This is calculated by looking at the budget at completion (BAC), and subtracting the money (or hours) you have spent so far (ACWP).

This page gives a sense for the logic and intuition behind earned value calculations. If you chose to use them, they can be a valuable tool for determining where you are at in terms of budget and schedule. There are other calculations that can be included as well to give a fuller picture of the project status, if you have collected the basic information shown here.

3.3 Manage the Workplan / Deliverables

Size	Information Needed
Small Medium Large	Deliverable: Updated Project Workplan and Associated Reports The major deliverable from this step is the updated Project Workplan . In addition, for projects that use a project management tool, there may be additional information that needs to be shared through one or more of the many reports that can be generated. For instance, a list of assigned activities can be created for all team members, or a high-

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	level milestone status chart can be created for management and the customers. Reports showing budget status can be created if the information is tracked on the workplan. There are dozens of reports that can be created. Work with your team, your manager and your customers to determine which ones would provide the most value.
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3.4 Manage the Workplan / Additional Workplan Activities

Size	Information Needed		
Small	Small projects do not need specific activities around managing and updating the workplan. However, after reviewing the activities for larger projects, you can add additional workplan items if appropriate.		
Medium	Activity	Effort	Comments
	Update the Workplan	1-4 hours	Weekly. Always assigned to the Project Manager, although some updates can also be assigned to team members. Usually done on a Friday or Monday.
Large	Activity	Effort	Comments
	Update the Workplan	4-8 hours	Weekly or bi-weekly. Always assigned to the Project Manager, although some updates can also be assigned to team members. There may be a person(s) assigned to do some of the logistics associated with updating the workplan. If so, place a second activity in the workplan for that person's work. Usually done on a Friday or Monday.

4.0 Manage Issues

Definition: An issue is defined as a problem that will impede the progress of the project and cannot be resolved by the Project Manager and project team without outside help.

If a problem arises the Project Manager and the team can resolve, then it is just one of the many fires that will ignite and be put out in a given week. However, an 'issue' arises if outside help is needed. This is the time to ensure that a process is in place to make the appropriate people are aware of what the issue and then resolve the issue as quickly as possible.

Issues management is one of the fundamental processes of the SPS Project Management Process. Issues management is one of the skills that all Project Managers must master. Most projects of any size have to deal with issues. They cannot be ignored and they cannot be deferred to some later time. Issues must be resolved quickly and effectively.

4.1 Manage Issues / Process

4.2 Manage Issues / Techniques

4.3 Manage Issues / Deliverables

4.4 Manage Issues / Additional 'Build Workplan' Activities

4.1 Manage Issues / Process

The processes used to manage issues are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

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Small Projects

1. Problems can be surfaced by anyone on the project team. They should be sent in writing to the Project Manager by paper, email, etc. No formal form is needed.
2. The Project Manager determines whether the problem can be resolved, or whether it should be classified as an issue.
3. The Project Manager should prepare a plan for resolving the issue, and determine options if multiple courses of action are present. Impact on the **Project Workplan** should be identified.
4. The appropriate analysis, impact and alternatives should be taken to the Project Sponsor and other stakeholders for resolution.
5. If the resolution of the issue requires a change in scope, take the information gathered and invoke Scope Change procedures for small projects.
6. Once a resolution is agreed upon, the appropriate activities are added to the workplan to ensure the issue is resolved.
7. The issue, current status and resolution should be documented in the **Project Status Report**.

Medium Projects

1. Solicit potential issues from any project stakeholders, including the project team, customers, sponsors, etc. Potential issues should be documented in writing to the Project Manager through a short **Issues Form** (optional) or email.
2. Enter the issue into the **Issues Log** for tracking purposes.
3. Assign the issue to a project team member for investigation. (The Project Manager could assign it to them.) The team member will investigate the impact on budget and schedule for various viable options. If resolving the issue will involve changing the scope of the project, close the issue and use the Scope Management procedures.
4. Take the issue, alternatives and project impact to the Project Sponsor and other appropriate stakeholders for a resolution.
5. Document the resolution or course of action on the **Issues Log**.
6. Make the appropriate adjustments to the work plan and project budget, if necessary.
7. If the resolution of an issue causes the budget, effort or duration of the project to change the current **Project Definition** should be updated.
8. Communicate issue status and resolution to project team members and other appropriate stakeholders through the Manage Communication process, including the **Project Status Report**.

Large Projects

1. Solicit potential issues from any project stakeholders, including the project team, customers, sponsors, etc. The issue can be surfaced through verbal or written means, but it will be formally documented using an **Issues Form**.
2. Enter the issue into the **Issues Log**.
3. Assign the issue to a project team member for investigation. (The Project Manager could assign it to them.) The team member will investigate the impact on budget and schedule for various viable options. If resolving the issue will involve changing the scope of the project, close the issue and use the Scope Management procedures.
4. The various alternatives and impact on schedule and budget are documented on the **Issues Form**. Take the issue, alternatives and project impact on the **Issues Form** to the Project Sponsor and other appropriate stakeholders for a resolution.
5. Document the resolution or course of action on the **Issues Form**.
6. Document the issue resolution briefly on the **Issues Log**.
7. Make the appropriate adjustments to the work plan and project budget, if necessary.
8. If the resolution of an issue causes the budget, effort or duration of the project to change, the current **Project Definition** should be updated.
9. Communicate issue status and resolutions to project team members and other appropriate stakeholders through the Manage Communication process, including the **Project Status Report**.

4.2 Manage Issues / Techniques

Problem Solving Techniques

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People have been creating and solving problems for thousands of years. In the last few decades, formal techniques have been developed to help in the problem resolution process. These techniques can be very useful resolving issues on your project.

- 4.2.1 Manage Issues / Cause and Effect Analysis
- 4.2.2 Manage Issues / Root Cause Analysis
- 4.2.3 Manage Issues / Pareto Analysis

Resolve Issues as Soon As Possible

The definition of an issue is that it is a problem that will be detrimental to the success of the project and cannot be resolved internally by the project team. That definition leads you to understand that issues must be addressed quickly. If a problem is indeed being classified as an issue, either the Project Manager or one of the team members must take responsibility for getting it resolved. The Project Manager should have an activity in the workplan every week to follow-up on open issues to ensure they are being diligently resolved.

By the same reasoning, if there is no urgency to resolve the issue, or if the issue has been active for some time, then you should look again to see if it really is an issue. It may be a potential problem (risk), or it may be an action item that needs to be resolved at some later point. Issues by their nature must be resolved with a sense of urgency.

In some cases, issues arise that are hard to resolve not because of a lack of options, but because of the difficulty gaining approval and resolution among a number of alternatives. In other cases, there are no good alternatives, and the ultimate resolution may be one that is the least offensive. In these situations, try to get the approvers to understand that a delay in the resolution decision usually does not make the result any less palatable. The Project Manager should strive to gain a resolution as quickly as possible so that the project can move forward.

Try to Solve the Root Cause, Not Just Symptoms

When problems arise, they should be solved as quickly as possible. However, try to make sure you solve the root cause of the issue, not just the symptom. Solving the root cause will ensure that the problem does not resurface later on in the project. The root cause can usually be found by asking a series of 'why' questions. Why did the issue arise? When the question is answered, ask yourself 'why' again, and again. When you cannot answer the 'why' question again, you are probably close to the root cause. See 4.2.2 Manage Issues / Root Cause Analysis for more information.

Making Decisions Among Bad Alternatives

In some cases, issues arise that are hard to resolve not because of a lack of options, but because of the difficulty gaining approval and resolution among a number of alternatives. In other cases, there are no good alternatives, and the ultimate resolution may be one that is the least offensive. In these situations, try to get the approvers to understand that a delay in the resolution decision usually does not make the result any less palatable. The Project Manager should strive to gain a resolution as quickly as possible so that the project can move forward.

When Can Team Members Make Decisions?

After stressing the importance of raising issues and potential scope changes to the Project Manager, it may seem to some team members that they do not have the ability to make any decisions at all. You definitely do not want to get into that position. As a Project Manager, you need to encourage people to accept responsibility and make decisions when appropriate. This helps the team run more efficiently and allows individuals to grow professionally.

As a Project Manager, you need your team members to handle all the day-to-day problems and only bring items to you on an exception basis. At the same time, you resolve as much as you can, and only bring exceptions to the sponsor for assistance. In general, team members need to ask themselves some key questions before deciding if they need help, or if they can make a decision themselves.

- Is there an impact to effort, duration or cost? If there is, then the Project Manager must be involved.
- Will the decision require me to go out of scope, or deviate from previously agreed upon specifications? If so, then the Project Manager must be involved.
- Could the decision politically sensitive? If so, then the Project Manager must be involved.
- Will the decision require me to miss a previously agreed upon commitment? If so, the Project Manager must be involved.

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- Will the decision open the project to future risk? If so, then the Project Manager must be involved.

If none of these conditions are true, then the team member can make the decision? It may sound like there is nothing left, but in fact, most of the decisions that are required on a day-to-day basis do not meet these criteria and can be made by the team or individual team members.

Issues Vs Action Items

In many cases, items that are classified as issues are really just action items. Action items are areas that must be followed up on at some time. They may or may not involve problems for the project. Create a separate log for keeping track of action items. Or better still, place action items on the workplan, which will then remain the single source to track all project related activity. If you find that your Issues Log has dozens of items on it, then probably you are tracking action items. Because issues are large problems, there should not be many items open at any one time. For more information on action items, see 3.2.1 Manage Workplan / Action Items.

Identifying Problems and Solutions

Issues can come from team members, customers or any project stakeholder. It is a good practice to encourage people to help identify solutions along with the issues. So, when a team member identifies a potential issue, also ask them to bring one or more possible solutions. This process will help build accountability among the team members, but it will also help determine possible courses of action. In fact, if one or more solutions are viable, then the problem can be resolved with the help of the Project Manager, and never reach the level of an issue at all.

Engage the Client Early in Issues Management

Issues management tends to go more smoothly when the entire project team is comfortable working through the process from the very start. If issues arise early, be sure to follow your issues management process and get the client engaged in the solution. Issues become more urgent as you get closer to your end date. Don't let these be the first issues the client gets involved with. Earlier issues management experience will cause the business client to see problems as just temporary hurdles that need to be overcome. If you haven't engaged the business client earlier in the issues management process, they may cause more harm than good when you absolutely need them at the end.

Dealing with Very Large Issues

If a large issue looks too difficult to be resolved in a timely manner, break it down into logical sub-issues. In many cases, the resolution of an initial sub-issue will drive the solution for the remainder of the issue. If it does not, it at least lets people understand the components of the issue, so that they can be attacked and resolved individually.

Dealing with Multiple Issues

In many cases, issues arrive in pairs, or you may encounter a number of them in a short timeframe. First look to see if some are related. If so, then try to resolve the issue that looks like more of a root cause. The resolution of this one may substantially resolve another. If the issues look independent, try to resolve those with the most negative impact on the project first.

4.2.1 Manage Issues / Cause and Effect Analysis

This problem solving technique is a way to analyze complex problems that appear to have many interrelated causes. One of the key aspects of the technique is the use of a cause-and-effect diagram. Because of the appearance of the diagram, this technique is also called a Fishbone Diagram. (Another name you might hear for this technique is an Ishikawa Diagrams, named for Professor Kaoru Ishikawa, a Japanese professor who first utilized the diagram in 1943.) Benefits of this technique include:

- Allows various categories of causes to be explored.
- Encourages creativity through a brainstorming process.
- Provides a visual image of the problem and potential categories of causes

Developing the Fishbone Diagram

1. Describe the problem on the far right side of the diagram. This may be the actual problem or it may be a symptom - at this point you are not exactly sure.

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2. Draw a long horizontal arrow pointing to the box. This arrow will serve as the backbone from which further major and minor causes will be categorized and related.

3. Identify potential causes and group them into major categories. Examples of major categories include people, processes, material, equipment, environment, etc. The major categories are identified using brainstorming techniques, so at this point you are not worried if there is disagreement about whether a category holds the potential cause or not. Just put them all up. Make sure to leave enough space between the major categories on the diagram so that you can add minor detailed causes in a later. Each of these major categories will be explored in more detail.

4. Continue to brainstorm the causes by looking at more detailed explanations for each of the major cause categories identified above. Write the more detailed causes on slanted lines that hook up to the appropriate major category lines.
5. Sometimes, the detailed causes will have other, more granular causes coming off of them. If so, connect additional lines to the detailed lines. Three levels of detail is usually the practical limit for this diagram.

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6. When you are done brainstorming major categories and more detailed potential causes, begin analyzing the information you have compiled. Evaluate each major cause and the potential detailed causes associated with it. Remember that the original list was compiled by brainstorming, where all ideas are included. Now, you must determine which items seem like they are more likely to be the cause (or one of the causes). Circle the items that are most promising and should be investigated further.
7. If there is not an obvious consensus on the top areas to investigate, use some sort of voting system to formally narrow down the top choices with the most chance of success.
8. For each item circled, discuss how the item impacts the problem.
9. Create an action plan for resolving this cause. Remember that there may be a number of potential causes that interact together to create the problem. The action plan must account for these interdependencies. If the detailed causes are still complex, or if not enough information is known, they may be assigned to one or more people for further analysis outside of the meeting

Other Rules for the Cause and Effect Session

- Make sure everyone agrees on the problem you are trying to resolve. The brainstorming process can become chaotic and confusing if people are trying to resolve different problems.
- Use formal brainstorm techniques to gather the initial lists of major categories and detailed causes. All ideas should be included. Discussion should be limited to understanding the ideas - not reviewing them to see if they are valid or not.
- There may be a tendency to jump from major categories to solutions. Make sure that you explore all major and detailed causes before you turn to problem solving.
- Make sure the entire group can see the Fishbone Diagram, so that a connections and relationships are visually apparent.
- Don't let the diagram get too cluttered. If one category started to dominate the chart, it can be moved to a second diagram.
- Be aware of detailed causes that come up repeatedly in different major categories. This could be a sign of a root cause.

4.2.2 Manage Issues / Root Cause Analysis

Sometimes when we try to resolve a problem, we find that it is really a related symptom, not the actual cause of the problem itself. Consider the following classical example.

A plant manager walks past the assembly line, and notices a puddle of water on the floor. Knowing that the water is a safety hazard, he asks the supervisor to have someone get a mop and clean up the puddle. The plant manager is proud of himself for fixing a potential safety problem. The supervisor looks for a root cause by asking 'why?' He discovers that the water puddle is caused by a leak in an overhead pipe. He asks 'why' again, and discovers that the pipe is leaking because the water pressure is set too high. He asks 'why?' again and discovers that the water pressure valve is faulty. He asks 'why?' again, and does not get a further answer. So, the valve is replaced, which solves the symptom of water on the factory floor.

Root cause analysis is a way to identify the ultimate cause of a problem. Notice in the example above, there was many opportunities for solving the wrong problem. First, the plant manager could have ordered more mops to be available on the factory floor. The supervisor likewise could have ordered that the overhead pipe be replaced. However, these solutions would have ultimately been wasteful, and they would not have solved the problem, since they only addressed symptoms - not the problem itself.

Root cause analysis is usually accomplished by asking a series of 'why' questions. Just as the example above illustrates, you ask yourself 'why' a problem exists. Then you come up with one of more causes. For each of these causes, ask 'why' again. If you can answer that question again, then the first answer is probably a symptom, brought on by the more fundamental cause. Continue to ask why for each answer, until you can no longer generate a logical response. This lowest level is likely to be a root cause, and is what generates the observed symptoms. You may discover more than one root cause through this analysis.

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Now that you have identified the root cause(s), put an action plan in place to solve the problem. The symptoms should go away as well.

4.2.3 Manage Issues / Pareto Analysis

Pareto analysis can be used when you encounter multiple related problems, or a common problem with multiple causes. In this case, you are also able to collect metrics on how many times each problem or cause occurs. The purpose of Pareto Analysis is to observe the problems and determine their frequency of occurrence. This, in turn, gives you the information you need to prioritize your effort to ensure you are spending your time where it will have the most positive impact.

Pareto Analysis is based on the classical 80/20 rule. Let's say you have a problem with a product failure, based on a number of causes. Through observation and collecting metrics, you determine there are eight causes. Rather than attacking the causes randomly, a Pareto Analysis might show that 80% of the problems are caused by the top three causes. This gives you information to know which causes to solve first.

The tool associated with this problem solving technique is the Pareto Diagram. It is a chart, graph or histogram showing each problem and the frequency of occurrence. It is created as follows:

1. Create a table listing all observed problems or causes.
2. For each problem, identify the number of occurrences over a fixed period of time.

Problem 1	115
Problem 2	25
Problem 3	50
Problem 4	5
Problem 5	5
Problem 6	15

- 3.
4. Arrange the problems from highest to lowest, based on the number of occurrences.
5. Add a column for the cumulative total.

Problem 1	115	53%
Problem 3	50	77%
Problem 2	25	88%
Problem 6	15	95%
Problem 4	5	98%
Problem 5	5	100%

6. Notice that this gives us important information. Even though there are six total problems identified, you need to resolve problems #1 and #3 first. That is where you will get the most impact. If you decided to work on problems #4 and #5 instead, the result of your effort would be almost meaningless. This does not mean that you do not want to resolve the other problems. However, this Pareto Analysis gives you information in what order they should be attacked. It also provides a sense as to the relative value you receive for resolving each problem. You definitely do not want to spend the same amount of effort resolving problem #5 as you do for problem #1. They payback just isn't there.
7. Many times, you will see the results of the Pareto Diagram displayed as a histogram or bar chart. This provides more visual emphasis to the data you have observed.

4.3 Manage Issues / Deliverables

Size	Information Needed
Small	For small projects, issues and their current status should be identified on the Project Status Report in Step 6. Since there are not usually major issues on small projects, there are no required deliverables specifically for issues

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	management. However, review the Issues Log used in medium and large projects. This may be helpful if you find yourself dealing with multiple issues.
Medium	<p style="text-align: center;">Deliverable: Issues Log</p> <p>The Issues Log contains a summary of all issues. Use it to view open issues and make sure that issues resolution is proceeding. The log should contain enough information to ensure that issues are not overlooked but should not be so detailed that scanning becomes difficult. To maintain readability, make sure that the information can fit across a single sheet of paper or can be displayed in a single window. Each issue should be represented on one line of the Issues Log.</p> <p>Issue Number: An arbitrary numbering scheme, usually 1,2,3...</p> <p>Issue Description and Impact to Project: Briefly describe the issue and the impact on the project.</p> <p>Priority: Rate the relative importance/priority of this issue. This can be a H/M/L (High/Medium/Low) or a 1/2/3 scale.</p> <p>Date Reported: When was the issue identified?</p> <p>Reported By (Optional): Who reported the issue?</p> <p>Assigned To: Who is assigned to resolve the issue?</p> <p>Date Resolved: When was the issue resolved?</p> <p>Status: Usually either Pending (should not be for long), In Progress, Complete. (If you have a status of On Hold, it is probably not an issue.)</p> <p>Resolution/Comments: Briefly describe how the issue was resolved.</p>
Large	<p style="text-align: center;">(1) Deliverable: Issues Log (same as for medium projects) (2) Deliverable: Issues Submission Form</p> <p>Larger projects need more rigor in how issues are managed. This includes a more formal process for surfacing potential issues. The Issues Form is used to capture, screen and evaluate issues. Each form should be used to describe one specific issue. Be sure to include enough information so that the issue can be identified and tracked, but not so much information that the form becomes a report.</p> <p>Issue ID - Used to track the issue. This is now more formal than just a 1,2,3... system. There is probably some type of simple, but smart coding scheme to help categorize the issue. Whatever scheme is used should be used on the Issues Log as well, to tie the two.</p> <p>Reported By: Who reported the issue?</p> <p>Date Reported: When was the issue identified?</p> <p>Issue Status: Usually Pending (should not be for long), In Progress, Complete. (If you have a status of On Hold, it is probably not an issue.)</p> <p>Issue Assigned To: Who is assigned to resolve the issue?</p> <p>Date Resolved: When was the issue resolved?</p> <p>Description of Issue: Describe the issue with enough detail that others will be able to understand the problem. Be sure to note what the impact of the issue is on the project.</p> <p>Project Impact: Describe the impact to the project if the error is not resolved. Also describe the consequences of any delay in resolving the issue.</p> <p>Alternatives and Recommendation: Document what the different alternatives are to resolve the issue. This will usually be completed after the person assigned to resolve the issue performs initial analysis. For each alternative there should be an estimate of any cost, effort or duration impact on the project.</p> <p>Final Resolution: Briefly describe how the issue was resolved.</p>

4.4 Manage Issues / Additional Workplan Activities

Size	Information Needed		
Small	Small projects do not need specific workplan steps around managing issues. However, after reviewing the activities for larger projects, you can add appropriate workplan items if appropriate.		
Medium	Activity	Effort	Comments
	Review Status of Issues	1-2 hours	Weekly. Always assigned to the Project Manager. Use this time to

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			updated.
	Analyze Issue XXX	open	Add an activity for the analysis of any open issues that were assigned to a team member.
	Resolve Issue XXX	open	If the resolution of an issue requires additional work activities, they should be added to the workplan.
Large	Activity	Effort	Comments
	Review Status of Issues	1-2 hours	Weekly. Always assigned to the Project Manager. Use this time to ensure progress is being made on all issues and that the Issues Log is updated.
	Analyze Issue XXX	open	Add an activity for the analysis of any open issues that were assigned to a team member.
	Resolve Issue XXX	open	If the resolution of an issue requires additional work activities, they should be added to the workplan.
	Update Project Definition	open	Add an activity to update the Project Definition to reflect any changes required to cost, effort or duration because of the resolution of an issue.

5.0 Manage Scope

Definition: *Scope is the way that we describe the boundaries of the project. It defines what the project will deliver and what it will not deliver. For larger projects, it can include the organizations affected, the transactions affected, the data types included, etc.*

If you look at the reasons that projects fail, it is usually the result of two problems. Either the team did not spend enough time defining the project and/or there was a lack of scope management. Even if the Project Manager did a good job of defining scope, the hard part comes in having to manage the project to that scope.

First things first. Without proper scope definition in the Define Project step, you have no chance to manage scope effectively. Evoking the scope change process implied that a change is outside the scope agreed to in the **Project Definition**. If that scope is fuzzy, or leaves room for interpretation, then the customer will say that the change is within scope, and the Project Manager will find it difficult to make scope management stick.

The purpose of scope change management is to protect the viability of the current, approved Project Definition. When the project was defined, certain expectations were set as to what the project was going to produce for an agreed upon cost and within an agreed upon timeframe. If the deliverables change during the project (and usually this means that the customer wants additional items), then the estimates for cost, effort and duration may no longer be valid. If the sponsor agrees to include the new work into the project scope, then the Project Manager has the right to expect that the cost, effort and duration may be modified (usually increased) to reflect this additional work. This new cost / effort / duration now become the approved target. That is really the essence and purpose of scope change management – to ensure that the initial agreements are met, and that the project team and those same stakeholders agree to any changes to the expectations.

Sometimes the Project Manager thinks that scope management means having to tell the customer 'no'. That makes the Project Manager nervous and uncomfortable. *However, the good news is that effective scope management is the art of getting the Sponsor to say 'no'.* This is very important. Few projects can foresee every requirement during the analysis process. Therefore, there are usually changes that need to be introduced during the life cycle. These changes may be very necessary for the solution, and there may be valid business reasons why they should be included. The Project Manager and project team must recognize when these changes are requested. Then they must follow a predefined scope change process. This process ultimately brings the appropriate information to the Project Sponsor for resolution.

5.1 Manage Scope / Process

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5.2 Manage Scope / Techniques

5.3 Manage Scope / Deliverables

5.4 Manage Scope / Additional 'Build Workplan' Activities

5.1 Manage Scope / Process

The processes used to manage scope are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

Small Projects

1. Scope changes can be surfaced by anyone on the project team. They should be sent in writing to the Project Manager by paper, email, etc. No formal form is needed.
2. The Project Manager determines whether the request is a scope change request or not. If it is, then the rest of this process is executed.
3. The Project Manager determines what the impact of the scope change is to the project in terms of cost, effort and duration. If there are other viable options, determine their impact as well.
4. If the change request can be accommodated within the agreed upon cost, effort and duration, the Project Manager has the flexibility to approve the change. The Project Manager also has the ability to take all changes to the Project Sponsor.
5. The appropriate analysis, impact and alternatives are taken to the Project Sponsor for resolution (if the Project Manager did not approve, as above.) If the Sponsor does not approve the request and the corresponding impact, then the scope request is not pursued.
6. Once a resolution is agreed upon, the appropriate activities are added to the workplan to ensure the change is implemented.
7. The request, current status and resolution should be documented in the **Project Status Report**.

Medium Projects

1. Solicit potential scope changes from any project stakeholders, including the project team, customers, sponsors, etc. Potential scope changes should be documented in writing to the Project Manager through a short **Scope Change Request Form** (optional) or email.
2. Enter the item into the **Scope Change Log** for tracking purposes.
3. Assign the scope change to a project team member for investigation. The team member will first determine how much time it will take to investigate the scope change request. If the time required to perform the analysis will cause deliverable dates to slip, then the request must first be taken to the Project Sponsor to determine whether the request should be investigated or not. If the sponsor gives the initial approval to proceed, then the workplan and budget may need to be updated to reflect this new work. If the Sponsor does not agree to investigate the change request, then the request should be closed as 'not approved' on the **Scope Change Log**.
4. (Optional: If the impact on project cost, effort and duration fall below a threshold (say under 20 hours), and the project will still be completed within the agreed upon cost, effort and duration, then the Project Manager may approve the scope change request. This threshold needs to be identified and approved in advance. The purpose is to keep from surfacing many small changes to the Sponsor for approval. See the techniques section for other ways to handle small requests.)
5. Take the issue, alternatives and project impact to the Project Sponsor for a resolution (if the Project Manager did not approve, as above.)
6. Document the resolution or course of action on the **Scope Change Log**. If the Sponsor does not agree to the change request, then the request should be closed as 'not approved' on the **Scope Change Log**.
7. If the resolution is agreed upon, the appropriate activities are added to the workplan to ensure the change is implemented. The project budget should also be updated, if necessary.

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8. If an approved scope change results in a substantial change to the project, the original **Project Definition** should be updated.
9. Communicate scope change status and resolution to project team members and other appropriate stakeholders through the Manage Communication process, including the **Project Status Report**.

Large Projects

1. Solicit potential scope change requests from any project stakeholders, including the project team, customers, sponsors, etc. The issue can be surfaced through verbal or written means, but it will be formally documented using a **Scope Change Request Form**.
2. Enter the request into the **Scope Change Log**.
3. Assign the scope change to a project team member for investigation. The team member will investigate the impact on budget and schedule for various viable options. The team member will first determine how much time it will take to investigate the scope change request. If the time required to perform the analysis will cause deliverable dates to slip, then the request must first be taken to the Project Sponsor to determine whether the request should be investigated or not. If the sponsor gives the initial approval to proceed, then the workplan and budget may need to be updated to reflect this new work. The options are documented on the **Scope Change Request Form**. If the Sponsor does not agree to investigate the change request, then the request should be placed closed as 'not approved' on the **Scope Change Log**.
4. (Optional: If the impact on project cost, effort and duration fall below some threshold, and the project will still be completed within the agreed upon cost, effort and duration, then the Project Manager may approve the scope change request. This threshold needs to be identified and approved in advance. The purpose is to keep from surfacing many small changes to the Sponsor for approval. See the techniques section for other ways to handle small requests.)
5. Take the scope change request, alternatives and project impact on the **Scope Change Request Form** to the Project Sponsor for a resolution.
6. Document the resolution or course of action on the **Scope Change Request Form**.
7. Document the resolution briefly on the **Scope Change Log**. If the Sponsor does not agree to the change request, then the request should be closed as 'not approved' on the **Scope Change Log**.
8. If the resolution is agreed upon, the appropriate activities are added to the workplan to ensure the change is implemented. The project budget should also be updated, if necessary. If the resolution is not approved, note it as closed on the **Scope Change Log**.
9. If an approved scope change results in a substantial change to the project, the original **Project Definition** should be updated.
10. Communicate scope change status and resolution to project team members and other appropriate stakeholders through the Manage Communication process, including the **Project Status Report**.

5.1.1 Defining Scope

Defining scope is perhaps the most important part of the upfront planning process? In fact, if you don't know for sure what you are delivering and what the boundaries of the project are, you have no chance for success. Managing scope is one of the most critical aspects of managing a project. However, if you have not done a good job of defining scope, managing scope will be almost impossible.

The purpose of defining scope is to clearly describe and gain agreement on the logical boundaries of your project. Scope statements are used to define what is within the boundaries of the project and what is outside those boundaries. The more aspects of scope you can identify and define, the better off your project will be. The following types of information can be helpful.

- The types of deliverables that are in scope and out of scope. (Business Requirements, Current State Assessment)
- The major life-cycle processes that are in scope and out of scope. (Analysis, design, testing)
- The types of data that are in scope and out of scope. (Financial, sales, employee)
- The data sources (or databases) that are in scope and out of scope. (Billing, General Ledger, Payroll)
- The organizations that are in scope and out of scope. (Human Resources, Manufacturing, vendors)
- The major functionality that is in scope and out of scope. (Decision support, data entry, management reporting)

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When the project was proposed for funding, there should have been an initial set of objectives and deliverables defined. There may even be some type of high-level scope statement. Any information that was created earlier should be used as the starting point for defining the more detailed scope statements. If you find that you do not have enough information to create a clear and comprehensive scope statement, you must work with the sponsor to gather additional information. That is the purpose of the planning process.

In most cases, the easiest place to start defining scope is to look at the objectives. By definition, there needs to be one or more deliverables created to accomplish each objective. Looking at the deliverables then becomes the basis for the scope definition. After you determine what major deliverables the project will produce, start asking other questions to determine other aspects of scope. The deliverables describe 'what' the project will deliver. You can also identify 'what' organizations are impacted, 'what' types of data are needed, 'what' features and functions are needed, etc.

As a point of clarity and contrast, you can also identify out-of-scope conditions by describing what deliverables will not be created, what organizations will not be impacted, what features and functions are not included, etc. Of course, there are an infinite number of out-of-scope statements. For the purposes of scope definition, you want to include only those statements that help define the project boundary, and touch upon related areas that the reader may have questions about. For instance, if you were installing financial software, you might state that a new Accounts Payable package is in scope, but the related Purchasing System is out of scope.

It is a good practice to document those organizations that are in scope and those related organizations that are out of scope. The readers can then determine more easily if they are impacted, or expected to assist in the project. Also, it may make sense to identify what organizations are in scope so that you can have people from those organizations represented on the project team - perhaps on a steering committee.

Aligning Objectives and Scope

When you have completed creating your objectives and scope statements, go back and make sure that they are all in alignment. You should not have any objectives that make references to deliverables that are not defined in scope. Likewise, you don't want to include scope in your project that does not help to achieve the project objectives. If the two areas are not in full agreement, either the scope or the objectives (or both) must be modified to bring everything into alignment.

5.2 Manage Scope / Techniques

Batching Small Requests

It is not always practical to get the Sponsor to approve all small scope change requests. The project team usually does not have day-to-day access to the Sponsor, and it is hard to get the Sponsor's attention for many small requests. It is a better use of time to batch the small changes up into a bundle. Then discuss them as a batch with the sponsor. For example, you may have five to ten requests that are taken up to the Sponsor at one time for resolution.

Project Manager Discretion

It usually makes sense for the Project Manager to be given discretion to approve small scope change requests, under some threshold of effort hours. However, this assumes that the project is on or ahead of schedule, and that the changes do not make the project exceed the agreed upon cost, effort or duration. On the other hand, if the project is in any risk of not making its cost, effort or duration commitments, then the Project Manager should not approve any scope change requests on their own - not even for one hour! If the project is at risk, all scope change requests must go to the Sponsor for resolution.

Do Not Use Estimating Contingency for Scope Changes

One of the steps in the estimating process is to add contingency hours to reflect the level of uncertainty associated with the estimate. (For instance, if the effort hours were estimated at 5,000 hours, you might add 500 hours for contingency, which reflects a 90% confidence factor.) Once the contingency is approved, there will be pressure on the Project Manager to use the contingency to absorb additional requirements. The customer might say, "Why do we need to invoke scope change management for this 100 hour enhancement. You have 500 hours of padding built into your estimate!"

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Resist the temptation and the pressure! The purpose of the estimating contingency is to reflect uncertainty in the estimates. There will be plenty of opportunities to absorb the contingency when activities take longer than expected. All scope change requests need to go through the approval process. If they are approved, then effort, duration and budget will be adjusted accordingly. Do not use the estimating contingency to absorb extra work. If the project estimates were fairly accurate, you can return the contingency to the customer at the end of the project. (Or consider the contingency to be profit if an external customer.)

Freezing Scope Change Requests

Do you think that as long as you are managing scope change requests diligently, the customer should be free to make changes all the way through the project? It is true that changes toward the end of the project tend to take more time and effort to accommodate. However, you might think that as long as the sponsor is willing to approve increases in budget and time to make the change, they should be able to do it. This is, in fact, normally true, but only up to a point. There comes a time in a project where it just doesn't pay to make additional changes, or absorb additional requirements. That is the time to gain a commitment for a change freeze. Depending on the nature of the project, this freeze could be implemented at various times, but is usually done no later than the beginning of system testing. At that point, the team needs to focus on rigorously testing the current solution. Additional changes could result in having to do all the testing again. By system testing, you should have accounted for the vast majority of what is required.

It is common for change requests to come out of the user acceptance testing. The customer may see other things they want changed as a result of their testing. The better approach is to hold these changes on a backlog and deal with them as enhancement requests after the solution is implemented and stable. (This refers to change requests and not bugs. The users may uncover bugs and errors in their testing that need to be fixed before implementation.)

If you get agreement on a change freeze date, your team can focus on delivering the current solution. Of course, like all processes, if there is a change request that must go in, you can still allow the sponsor to make the call. However, gaining agreement on a freeze date will eliminate the need for additional changes on most projects.

Approval - The Project Sponsor Versus End Users

A typical problem on a project is that the team does not understand who the customer is and who the end users are. In general, the Project Sponsor is the person who is funding the project. If the customer were embodied in one person, it would be the Project Sponsor. They are probably high up in the organization and not easy to see on a day-to-day basis. In most cases, they designate someone else in their organization to make most decisions on a daily basis. The people that the project team tends to work with most often are end users. End users are the people who use the solution that the project is building. The end users are the ones who will generally make requests for changes to deliverables. It doesn't matter how important a change is to an end user - the end users cannot make scope change decisions and they cannot give your team the approval to make a scope change. In proper scope change management, the sponsor (or their designate) must give the approval. The end user cannot allocate additional funding to cover the changes and they cannot know if the project impact is acceptable. The end user cannot make those decisions for the Sponsor. If the change is important enough to the Sponsor, they will approve the change, along with the appropriate budget and duration changes. If the change is not important enough, then the change will not be approved. However, it will be the Sponsor making the decision, not the Project Manager, project team or end users.

Is Saying 'Yes' to Scope Change Requests Showing Good Customer Focus?

The Project Manager and project team sometimes think that they are being customer focused by accepting scope change while still trying to deliver the project within the original commitments. However, if the project is delivered late or over budget, it is usually not good enough to point out all the additional work that was included because of this 'customer focus'. The Project Sponsor and your management don't want to hear about it. In most cases, the project will not be seen as successful, since it did not deliver as promised within the original budget and delivery date expectations.

The Sponsor Will Usually Say 'No'

One of the neat things about enforcing the discipline of having the Sponsor approve scope change requests is that, unless the change is very important, the Sponsor will usually say 'no'. Again, the Sponsor is usually someone high in the organization. They don't want to hear about requests for small changes. They want the original project fulfilled within the original

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commitments for cost, effort and duration. Even though it may be hard for the Project Manager to say 'no', the Project Sponsor usually doesn't have any problem saying it.

Scope Creep

Most Project Managers know to invoke scope change management procedures if they are asked to add a major new function or a major new deliverable to their project. However, sometimes it does not seem worthwhile to invoke these procedures if the change requested is small. Scope creep is a term used to define a series of small changes that are made to the project without scope change management procedures used. One change seems small, with little project impact. Two changes seem small, with little project impact. Three changes seem small, etc. What happens is that a series of small changes, none of which appear to have much project impact on their own, accumulate to have a significant impact on the project. Many projects fail because of scope creep, and the Project Manager needs to be diligent in guarding against it.

As mentioned earlier, the Project Manager may have discretion in approving these small changes, as long as there is no impact to budget or schedule. Even here, however, the changes should be approved according to the documented procedures. However, if the project is at any risk of missing its dates, the better approach for small changes is to batch them together into one more significant request, and invoke scope change procedures for this larger unit (see above).

Hold Everyone Accountable for Scope Management Process

Many scope management processes work well at the Project Manager level, but get compromised by team members. If the Project Manager is diligent in enforcing the scope change rules, the customer may try to go directly to team members for changes. For instance, when an agreed upon report is delivered for review, the customer may request a second report to provide more clarity. The team member may agree to the work (showing 'customer focus'). The result is that the activity takes too long, or resources that could have been applied to other high priority work get absorbed working in an area out of scope. The bottom line is that everyone needs to be held accountable for the scope management process. Team members must understand the process and why it is important. The customer community must understand the process and its importance. Don't consider these procedures to be only of interest to the Project Manager and the Sponsor. Be proactive in communicating to the entire team. When customers request scope changes, bring this to the attention of the Sponsor. When team members make commitments for work that is out of scope, deal with it promptly. The first time it may be considered a training matter. The next time it is a performance problem.

The Change Control Board

Sometimes in projects that are very large, the Project Sponsor does not feel comfortable making the scope change decisions alone. This may especially be the case if the effect of the change will impact other organizations. It may also be the case that multiple organizations are participating in, or contributing to, the project funding, and so want to have some say in evaluating scope change requests. For these cases, a group of people might be needed to handle the scope change approval. A common name for this group is a Change Control Board. If a Board exists, it may be more cumbersome to work through. However, the general scope change management process does not need to change dramatically. For instance, there is still a document that initiates the scope change request. The team project needs to determine the impact and cost to the project. The Board must consider the impact, the value to the project, the timing, etc., and then make a determination as to whether the request is accepted or not.

The Scope Change Plan must be somewhat more sophisticated to account for the Board. For instance, you need to clarify who is on the Board, how often they will meet, how they will be notified in emergencies, how they will reach decisions (consensus, majority, unanimous, etc.), how incremental work will be paid for, etc.

The Backlog

It is possible that the sponsor may not approve scope change requests, but they may be valid requests that can be done at a later time. These types of change requests should be captured on a backlog list. After the project is completed and the solution is moved to production, there may be opportunities for enhancements, or a Phase II project. Again, these changes will be made if they are approved and if funding is made available.

5.3 Manage Scope / Deliverables

Size	Information Needed
Small	For small projects, scope change requests and their current status should be identified on the Project Status Report

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	in Step 6. Since there are not usually major scope changes on small projects, there are no required deliverables specifically for scope change management. However, review the Scope Change Log used in medium and large projects. This may be helpful if you find yourself dealing with multiple scope changes.
Medium	<p style="text-align: center;">Deliverable: Scope Change Log</p> <p>The Scope Change Log contains a summary of all scope change requests. Use it to view open requests and make sure that scope change resolution is proceeding. The log should contain enough information to ensure that scope changes are not overlooked but should not be so detailed that scanning becomes difficult. To maintain readability, make sure that the information can fit across a single sheet of paper or can be displayed in a single window. Each scope change request should be represented on one line of the Scope Change Log.</p> <p>Scope Change Number: An arbitrary numbering scheme, usually 1,2,3...</p> <p>Scope Change Description: Briefly describe the scope change request.</p> <p>Priority: Rate the relative importance/priority of this request. This can be a H/M/L (High/Medium/Low) or a 1/2/3 scale.</p> <p>Date Reported: When was the scope change requested?</p> <p>Requested By: Who requested the scope change?</p> <p>Assigned To: Who is assigned to investigate the change and determine impact to the project?</p> <p>Date Resolved: When was the scope change request resolved?</p> <p>Status: Usually either Pending, On Hold, In Progress, Complete, Not Approved.</p> <p>Resolution / Comments: Briefly describe how the scope change was resolved.</p>
Large	<p style="text-align: center;">(1) Deliverable: Scope Change Log (same as for medium projects) (2) Deliverable: Scope Change Request Form</p> <p>Larger projects need more rigor in how scope changes are managed. This includes a more formal process for surfacing potential changes. The Scope Change Request Form is used to capture, screen and evaluate scope changes. Each form should be used to describe one specific scope change. Be sure to include enough information so that the scope change request can be identified and tracked, but not so much information that the form becomes a report.</p> <p>Scope Change Number - Used to track the request. This is now more formal than just a 1,2,3... system. There is probably some type of simple, but smart coding scheme to help categorize the scope change request. Whatever scheme is used should be used on the Scope Change Log as well, to tie the two.</p> <p>Requested By: Who requested the scope change?</p> <p>Date Reported: When was the change requested?</p> <p>Status: Usually Pending, On Hold, In Progress, Complete, Not Approved</p> <p>Assigned To: Who is assigned to investigate the scope change?</p> <p>Date Resolved: When was the request resolved?</p> <p>Scope Change Description: Describe the change with enough detail that others will be able to understand what is being requested. (Completed by Requestor.)</p> <p>Business Benefit: Why is the request being made? What is the benefit from a business perspective? (Completed by Requestor.)</p> <p>Implication of Not Making the Change: Describe the consequences if the change is not made. (Completed by Requestor.)</p> <p>Impact Analysis to the Project: Describe how the change would be incorporated into the project, as well as the impact to the project in terms of cost, effort hours and duration.</p> <p>Alternatives: If there are any alternatives, note them here, as well as the impact on cost, effort and duration.</p> <p>Final Resolution: Briefly describe how the scope change was resolved.</p> <p>Approval From Sponsor to Investigate (If Necessary):</p> <p>Approval From Sponsor for Final Resolution: Signifies that the Project Sponsor agrees to the resolution, including any budget, effort and / or duration implications.</p>

5.4 Manage Scope / Additional Workplan Activities

Size	Information Needed
Small	Small projects do not need specific workplan steps around managing scope. However, after reviewing the activities

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	for larger projects, you can add additional workplan items if appropriate.		
Medium	Activity	Effort	Comments
	Review Status of Scope Change Requests	1-2 hours	Weekly. Always assigned to the Project Manager. Use this time to ensure progress is being made on all scope change requests and that the Scope Change Log is updated.
	Analyze Scope Change XXX	open	Add an activity for the analysis of any open scope change requests that were assigned to a team member.
	Resolve Scope Change XXX	open	If the resolution of a scope change request requires additional work activities, they should be added to the Project Workplan .
Large	Activity	Effort	Comments
	Review Status of Scope Change Requests	1-2 hours	Weekly. Always assigned to the Project Manager. Use this time to ensure progress is being made on all scope change requests and that the Scope Change Log is updated.
	Analyze Scope Change XXX	open	Add an activity for the analysis of any open scope change requests that were assigned to a team member.
	Resolve Scope Change XXX	open	If the resolution of a scope change request requires additional work activities, they should be added to the Project Workplan .
	Update Project Definition	open	Add an activity to update the Project Definition to reflect any major approved scope change requests, or if a number of small approved changes make the current Project Definition invalid.

6.0 Manage Communications

Properly communicating on a project is a critical success factor for managing the expectations of the customer and the stakeholders. If these people are not kept well informed of the project progress there is a much greater chance of problems and difficulties due to differing levels of expectations. In fact, in many cases where conflicts arise, it is not because of the actual problem, but because the customer or manager was surprised.

All projects should communicate status. This includes reporting from the project team to the Project Manager and reporting from the Project Manager to the customers and stakeholders. Two typical forums for communicating status are through a Status Meeting and **Status Reports**. Larger projects need to be more sophisticated in how they communicate to various constituents. This multi-faceted approach is defined in a **Communications Plan**.

6.1 Manage Communication / Process

6.2 Manage Communication / Techniques

6.3 Manage Communication / Deliverables

6.4 Manage Communication / Additional 'Build Workplan' Activities

6.1 Manage Communication / Process

The processes used to manage communication are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

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Note that in all the cases where the term **Project Status Report** is used, this does not necessarily imply a written report (see techniques). Verbal updates, voicemail, conference calls, collaborative tools, etc., are all valid means of communicating status.

Small Projects

Small projects usually do not need more than basic status reporting. If the Project Manager is doing any hands-on work on the project, they probably have a very good idea of the overall status. However, if they are not working on the project, they may need a formal status reporting process. The following process would be typical.

1. Project team members send a status update to the Project Manager on a weekly basis.
2. The Project Manager sends a status update to the Project Sponsor and stakeholders on a bi-weekly or monthly basis. Note: Be careful about monthly reporting. If the project is very small, the customer may get no updates before the project is completed, or maybe just one. This does not give them time to react if they see anything unusual. Report bi-weekly or weekly in those cases.
3. The entire project team attends project status meetings. The meetings should focus on the status against the **Project Workplan** and uncovering any current issues, scope change requests or potential risks. The customer should be invited to attend, but their attendance is not mandatory. The frequency of the meeting depends on the timetable for the project, and the need to get information in a timely manner. If the project is three weeks, then the team might want to meet twice a week. If the project is eight weeks, then weekly is probably appropriate.

Medium Projects

The communication should include formal status meetings and **Status Reports**. In the smaller project, these could be fairly informal. For a medium project, these activities should be formalized.

1. **Status Meetings**: The customer should definitely have representation at the status meeting. If the Project Manager prefers, there could be a status meetings for the project team and a separate meeting with the customer. There should be a standard agenda for the meetings. In general, the purpose of the meetings is to communicate status, not solve problems. The meetings should be held weekly or bi-weekly, and kept to no more than one hour. The agenda for the meeting is included in the deliverable section.
2. **Status Reports to Customer Stakeholders**: There should be a formal **Status Report** sent from the Project Manager to the project stakeholders on a monthly basis. Depending on the financial reporting cycle, the monthly **Status Report** should include a financial status as well.
3. **Status Reports from team members to Project Manager**: The project team members should send a weekly or bi-weekly **Status Report** to the Project Manager. This is in addition to the status meeting.
4. A typical sequencing is for the project team to have a status meeting on Monday or Tuesday, with the weekly/bi-weekly team member **Status Reports** due to the Project Manager by Friday morning. This process ensures that the Project Manager is up-to-date on all project activities, and is prepared for productive status meetings with the project team and the customer.
5. On a monthly basis, usually after the financial systems close, the Project Manager issues a formal monthly **Status Report** to the stakeholders, including financial information about the project.

Large Projects

In a large project, all communication takes place in context of an overall communications strategy and plan. Status meetings and status reporting are required, just as for a medium size project. In addition, there are many other types of proactive communication that need to be considered. This creative and proactive communication is laid out in a **Communication Plan**, which is created as follows.

1. Determine the project stakeholders. In some cases these are groups of stakeholders with similar communications needs, for instance, a Project Steering Committee. In other cases, there may be a single person, for instance the Sponsor.
2. Determine the communication needs for each stakeholder, and what you are trying to accomplish. Usually this breaks down into three general areas:
 - **Mandatory**: generally includes **Project Status Reports**, legal requirements, financial reporting, etc. This information is pushed out to the recipients.

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- **Informational:** information people want to know, or that they may need for their jobs. This information is usually made available for people to read, but requires them to take the initiative, or pull the communication.
 - **Marketing:** designed to build buy-in and enthusiasm for the project and its deliverables. This type of information is pushed out to the appropriate people. For projects that will require the organization culture or work habits to change you may also want to "brand" the project. (see 6.1.2 Manage Communication / Branding a Project).
3. For each stakeholder/objective, brainstorm how to fulfill the communication need. Determine what information they need to know, how often they need an update, and what the best manner is to deliver the information. At this point, be creative in looking for ways to communicate to the project stakeholders. For instance, all stakeholders still need an updated project status. The Steering Committee may need to get together for an executive briefing and to provide strategic direction every other month. The Project Sponsor may need a personal briefing on a monthly basis. A quarterly newsletter may need to go out to the entire customer organization on a quarterly basis for informational and marketing purposes. For other examples of communication mechanisms, see 6.1.1 Manage Communication / Communication Plan Examples.
 4. Determine the effort required to create and distribute each of the identified communication options outlined in step 2. Also determine what the potential benefit of the communication is.
 5. Prioritize the communication options that were established above. Discard those that require high effort for marginal benefit. Also discard those that provide marginal benefit, even though they may take little effort from the project team. Implement the communication options that provide high value and require low effort from the project team. Also evaluate those options that have high value and require a high level of effort from the project team. Some of these might make sense, others may not.
 6. Regardless of the prioritization, implement any communication options that are mandatory for the project or for the environment. This could include **Project Status Reports**, government required reports, legal reports, etc.
 7. Add the resulting communication activities to the workplan. This will include assigning frequencies, due dates, effort hours and a responsible person(s) for each communication option implemented.

6.1.1 Manage Communication / Communication Plan

Examples

The following items are examples of the kinds of communications that could be used as part of an overall Communication Plan.

Mandatory: The types of communication that is required by your company, your industry or by law. This information is pushed to recipients.

- **Project Status Reports**
- Regular voicemail updates (of status)
- Status meetings
- Meetings with steering committee
- Regular conference calls and videoconferences with remote stakeholders
- Government required reports and other information
- Financial reporting such as budget vs. actuals, or any other required financial information

Informational: This is information people want to know, or that they may need for their jobs. This information is made available for people to read, but requires them to take the initiative, or pull the communication.

- Awareness building sessions that people are invited to attend. (These are not meant as training, just to build awareness.)
- Project paper-based deliverables placed in a common repository, directory or library that people can access
- Project information on a website

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Marketing: These are designed to build buy-in and enthusiasm for the project and its deliverables. This type of communication is also pushed to the readers.

- Project newsletters, with positive marketing spin
- Meeting one-on-one with key stakeholders on an ongoing basis
- Traveling road shows to various locations and departments to explain project and benefits
- Testimonials from others where value was provided
- Contests with simple prizes to build excitement
- Project acronyms and slogans to portray positive images of the project
- Project countdown till live date
- Informal (but purposeful) walking around to talk up the project to team members, users and stakeholder.
- Celebrations to bring visibility to the completion of major milestones
- Project memorabilia with project name or image portrayed, such as pins, pencils, frisbees, cups, T-shirts, etc.
- Publicizing accomplishments

The point of the examples is to show that project communication can take many shapes and forms. For large projects especially, the project team should be creative in determining how, what, to whom, where and how frequently the communication takes place. If the project is controversial, requires culture change or is highly political, the positive aspects of marketing communication become more and more critical. On these cases, you can also put a proactive plan in place to brand the project. (See 6.1.2 Manage Communication / Branding a Project).

6.1.2 Manage Communication / Branding a Project

Remember that there are three major categories of communication within a Communication Plan - mandatory, informational and marketing. Your project will probably always have mandatory communications, and you will want to add information communication as well if the project is of any size. Marketing communication is where the creativity comes in. Most projects have no requirements for this type of communication, and it is more appropriate in some than others.

Branding is a more sophisticated form of marketing communication. The purpose of branding a project is to establish an identity that conjures up a positive image and goodwill. This is exactly what the marketing people try to do when they brand a product. For instance, The Coca-Cola Company hopes that you feel good about their products and that you will choose their products from a crowded store shelf because you like the image associated with it. Maybe it works.

Branding a project has the same connotation. What you are trying to do is associate an image and a feeling when a person hears of your project. Hopefully, it is a good image and feeling. This is not something most projects need to be concerned about. However, consider the implications that your project will have on the organization. Does it impact a large number of people, or maybe the entire company? Will it require a culture change or a change in the way people do their job? Will your project make people nervous? For instance, will it result in efficiencies so that less people are required to do the same function? These are some of the reasons that you may want to brand your project. When people hear of your project, do you want them to think of future challenges, or do you want them to think about how screwed up things are around here? Should they think of the company responding to competitive challenges or should they be wondering if the project would cost them their job. Most large projects have an image associated with them. Branding helps you proactively build the image you want to portray, rather than have one branded on you. Of course, branding takes time, so you also need to have a project with at long time horizon.

There are activities that a project can perform to help with the branding campaign. If possible, you should consider meeting with your marketing department to gather more ideas and get help with how to establish a brand and how to successfully implement it. Examples of activities include:

- Establish a positive project name. For instance, a project called Market Force, probably gives more of a positive image than one called Marketing Process Improvement Initiative. A similar idea is a catchy acronym. In general, it seems all great projects have an acronym.
- Establish an image / logo. The project should have an image or logo associated with it. The image must be positive, and it should be included on all communication going from the team.

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- Trinkets. Put your project name or logo on pins, t-shirts, pencils, Frisbees, etc. When people go to class, or do something good, reward them with a token, with the project logo.
- Face-to-face meetings. Especially at the beginning of a project, spend the time to see everyone in a person-to-person basis. No one wants to hear about an important project on email. It cheapens the project.
- Other ideas include lunch & learns, a series of simple words to associate with the project logo, gathering testimonials of happy users, ongoing personal communications, etc. Find ways to keep your project and your message in front of people.

Of course all of this is contingent on also including a steady stream of informational content as well. A steady stream of information, combined with the positive feeling of the project branding will help the project be successful and should help overcome any negative perceptions about the project and its purpose.

6.2 Manage Communication / Techniques

Stay Focused at Status Meetings

If you find that you are spending too much time in status meetings, it is usually a sign of too much problem solving. While you have everyone together, use the time to discuss general status, issues, scope and risk. The best way to focus status meetings that are too long is to simply reduce the time allocated to them. For instance, if you meet for two hours per week and find that you cannot get all your work done, try reducing the time of the meetings to 90 or 60 minutes. Keep the status meetings short with a tight agenda to be most effective, and take any lengthy discussions offline, or to separate meeting to focus on these items.

Meeting Fundamentals

In general, all meetings should have an agenda. The creation of the agenda takes a little extra work, but it can be as simple as writing it in an email and sending it to the meeting participants. Regularly scheduled meetings do not need a published agenda every week, if they stick to the same agenda format. In those cases, the agenda is of value while the team is first meeting. Once everyone understands the purpose and standard agenda, a basic model can be reused every time. The agenda should be sent out ahead of time. Other meeting considerations include:

- There should be a meeting facilitator, although the role can be rotated for regularly scheduled meetings. This is usually the person who requested the meeting, unless other arrangements have been made.
- Make sure the participants know ahead of time of anything they need to bring to the meeting, or any advance preparation that needs to take place.
- Only those people that need to be there should be invited. Others may dilute the effectiveness of the meeting.
- The meeting should start on time, with some allowance for those that may be coming from another meeting.
- The person who requested the meeting should explain the purpose and what is the expected outcome.
- Follow the agenda, and watch the time, to make sure everything gets covered.
- Someone should document any action items during the meeting. This will be the facilitator unless other arrangements have been made.
- Toward the end of the meeting, recap all outstanding action items, including who is responsible, what is expected, and when the action item is due.
- Recap any decisions that were made, and document them in an email (or other project communication file, if appropriate).

Use Standardized Reports

Avoid creating individualized reports for each person who needs information. Most people need only a standard set of information that can be communicated in a common **Project Status Report**. If there is a need for information outside of that contained in a standard report, create an additional standard report to provide the information. For instance, you may have a detailed **Status Report** on a weekly basis, and a summary **Status Report** on a monthly basis. You should, however, minimize ad-hoc reporting as much as possible.

How Often Should Team Members Submit Status Reports?

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The frequency of status reporting is based on the length of the project, and the speed in which you need to react. For instance, if your project is two months long, and the Project Manager receives Status Reports from the team members on a monthly basis, there is not enough time to respond if problems are indicated. A good rule of thumb might be that for small projects, you may not need formal status reporting. For medium projects, every week might make sense. For large projects, every other week might be appropriate. On the other hand, if critical activities are occurring (for instance when the solution is being implemented) you may need status updates on a daily basis.

Include Useful Information in Status Reports, Not Just the Mundane

Let's face it. **Status Reports** are typically not as effective as they should be. This is true for team members that submit **Status Reports** to the Project Manager, as well as Project Managers who are submitting **Status Reports** to their major stakeholders. One of the reasons is that the people completing the reports look upon them as a chore and not as a way to communicate valuable information. You typically get the **Status Report** that is very brief and says nothing, or else you get the **Status Report** that contains all the mundane activities that a person did.

Try to focus the **Status Reports** so that the information in them can be used in the decision making process. Ask team members (and yourself) whether the information on the **Status Report** is there to really communicate something valuable, or is it just taking up space. With that in mind, what types of information should be included? Typically the **Status Report** should focus on the following:

- Accomplishments against the workplan
- Comments on work that should be completed, but is behind schedule
- Problems encountered, what the impact is, and what is being done to resolve them
- Scope change requests
- Newly identified risks
- Observations that will be useful to the reader

If you focus on this type of information in that **Status Report**, you will find that the information is meaningful and can be used as input to managing the project, or keeping the stakeholders informed. If you report on the trivial events of the reporting period, people will stop paying attention.

Use Appendices For More Details

You want to focus on meaningful information in the status report. However, you may find that some of your audience finds meaning in the exceptions, while others find meaning in the details. Does that mean you need to create two status reports? You should not need to. One of the ways to satisfy both audiences is to write the formal status report as an exception-based document, but include the details as appendices (attachments). For instance, most readers might want to know what was accomplished this period and what is planned for next period. However, your manager might want to see the entire workplan. Just include the workplan as an appendix. If you are emailing the information, you could email the current workplan as a separate document from the status. A similar situation exists if you note an accomplishment about completing a significant amount of training. Your customer might want to see the names of the people trained. Again, do not include this level of detail in the body of the report. Include the information in an appendix instead.

Less Information is needed as you go Higher in the Organization

If you create a specific Communication Plan, the needs of your target audience will be analyzed immediately. But even without a formal plan, always keep the organizational level of your audience in mind. It works like this. Your team members need information that is highly detailed and highly specific to the work they are assigned. As the Project Manager, you need information that covers the entire project, but at a less detailed level. Your manager needs to have information summarized and delivered at a higher level. Their manager needs information at a higher-level still. Although your project is the most important thing on your mind, to senior management it may just be one of a number of important events they are trying to keep track of. In some organizations, this filtering is a part of the communication system. For instance, you may give a status to your manager. Your manager receives the status from you, as well as from other direct reports. Your manager then summarizes and consolidates the information and passes a higher-level report to their manager. That manager in turn does the same thing until very high-level information reaches the top.

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However, in other organizations, the Project Manager needs to communicate with multiple levels themselves. In that case, remember that one size of communication does not fit all. You may need to modify the communication content to each level of management. For instance, you may send a one-page report to your direct manager and major customers showing the project status and financial situation. This may be summarized to a half-page for the next level of management, and to perhaps a paragraph to the next level.

Use the Best Communication Media

When you select the various type of communication that you need for your project, also determine the best medium for delivering the information. For instance

- **Status Reports** - do not have to be on paper. Depending on who is sending and receiving the information, the status can be communicated via voicemail, email, videoconference or other collaborative tools. Make reporting as easy as possible without compromising the value of the information.
- **Email** - use for routine messages and some marketing related messages. Spread these out so that they don't inundate the same people over a short period of time.
- **Voicemail** - leave simple messages, to either single persons or to entire departments. Complicated or long messages are not appropriate for voicemails.
- **Status Meetings** - leave time to discuss issues, scope change and risk. Meeting in person is the right time to deal with difficult subjects. Don't leave these to emails or impersonal communication media. However, keep the number to a minimum and be as focused as possible.

Don't Shoot the Messenger

You have all heard this saying (or something similar in a different language). It means that you do not take retribution against the person (or people) that deliver bad news. If you ask people for a status, accept the good and the bad for what it is – information for you to make better decisions. If you want people to tell them when there are problems, you need to accept the information and then work with the team on causes and solutions. (Hopefully the team member is proposing solutions along with the problem.) All Project Managers need to take this message to heart. You want to hear bad news as quickly as possible so that you have a chance to respond quickly. Issues and risks that are surfaced early allow you much more flexibility to respond. If you hear about them at the last minute, you have much less flexibility to operate. However, if people bring bad news to the you and you respond negatively toward the person bringing the news, it will make it much harder for other “messengers” to come forward with bad news in the future.

Green / Yellow / Red Status Indicators

One good technique for providing an overall summary of a project is to include a green / yellow / red indicator. Just as you would expect, a green indicator means that the project is basically on track. It does not imply that there are no problems at all. But it does mean that all problems are being addressed and the project is basically on time and on budget. A summary indicator of yellow means that there is some risk that the project will not meet its budget or deadline, and the project is trying to manage expectations. An indicator of red means that the project is definitely in trouble, and will need to compromise on budget, deadline and / or quality. The real value of this indicator occurs when the project status is summarized for upper management. If senior management has a summary page of all projects, as well as a green / yellow / red indicator, then they can easily see the overall status of the entire portfolio. If they manage by exception, they would immediately focus on those projects that are red and yellow.

Managing Expectations

Managing communication on a project is very much a matter of managing expectations. Providing status, for instance, is a way of communicating to stakeholders what's going on. The discussion of issues, scope change, risks, etc., is all a part of providing information to manage expectations. Managing expectations is more complicated than a simple 1,2,3 procedure. However, a general process for managing client expectations is discussed in detail at 6.2.1.Manage Communication / Managing Expectations.

Be clear on when Communication is Due

When a project begins, there is usually a set of guidelines around communication. You might need to create a monthly status report for your stakeholder. You may want to hold a weekly team status meeting. You may want to send out a quarterly newsletter update. As soon as possible, add these activities to the workplan, along with who is responsible and due dates. (If

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you created a formal Communication Plan, you should have this detail already.) You want to specifically plan out is the day and time the status meeting be held, as well as who the participants are. If status reports are to be distributed monthly, determine what day they be sent out? If you need status reports from your team members, decide when they will be due to you. If you are creating a newsletter, when is input due, and when will the newsletter do out? If you are not very specific on expectations and due dates, you will find these communication instances starting to slide. For instance, the quarterly newsletter will go out six weeks late, and then you will decide to skip next quarter since it is too close to the last one. Treat communication events like you would any project deliverable. Assign people and end dates, and make sure the team understands you expect to deliver these on time.

Branding a Project

Most IT projects don't have to worry about branding. Their scope is limited to a small set of people and the impact of the project on the organization is more modest. However, some projects will affect an entire organization or company, and may take years to implement fully. These are the types of projects where it makes sense to build a positive image and associated good feelings. They are candidates for branding. See 6.1.2 Manage Communication / Branding a Project for more information.

6.2.1 Manage Communication / Manage Expectations

Managing the expectations of the business client is important on all projects, but especially when the project is large, highly visible, political and / or business critical. When expectations are managed well, all parties feel good about the outcome, even if the project experiences a number of changes and challenges. When expectations are not managed well, even a project that comes in on time and on budget might be seen as unsuccessful.

Managing expectations means keeping the client informed as to how the project is going and what, if any, changes are being made to previous agreements and understandings. Major surprises can be fatal to a project. The Project Manager should ensure that client staff is involved in the project and that their expectations are always aligned with reality. The bottom line is that you want to make sure you call your customers before they call you.

The following process helps set an overall framework for successfully managing expectations.

1. **Establish an agreement**

This is probably the most overlooked, yet obvious piece. It is difficult or impossible to manage client expectations if you do not have some agreements to begin with. There are two places to gain the original agreement. The first is the Project Definition. One of the purposes of the Project Definition is to ensure that there is agreement on the project scope, deliverables, assumptions, risk, budget, timeline, etc. The next obvious area for gaining agreement is the business requirements. Documenting the business requirements and then having the client approve them is a major step in establishing initial agreement.

2. **Manage scope change**

If you do not have an agreement to start with, you have no chance to manage scope effectively. However, once an agreement has been reached, changes should be managed through the scope change management process. This ensures that the business client approved all changes and helps keep expectations in line.

3. **Deliver against the expectations**

Again, this may seem obvious. However, once an agreement has been put into place, you need to make sure that you deliver the work as expected.

4. **Communicate proactively**

When the agreement has been reached, continue to communicate proactively through some sort of status reporting process, or as part of a broader Communications Plan. This helps the business client keep up-to-date on progress, issues, risks, etc. The main motivation is to avoid surprises. Again, the key is to call your customers before they call you.

5. **Periodically assess performance**

If the timeframe for the agreement is lengthy, the Project Manager should assess the team and project performance on some regular interval. This will ensure that the agreement is being performed according to mutual expectations. If an assessment reveals that it has become unlikely or impossible to successfully complete the agreement, immediate steps should be taken to determine the new course of action and reset expectations.

6. **Reset expectations if necessary**

If it is determined that the original agreement cannot be satisfied, the agreement should be re-negotiated. This process

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includes gathering the facts surrounding the inability to meet the original agreement. In addition, alternative courses of action should be formulated to determine how to perform as closely to the original agreement as possible in a way that will satisfy both parties. Once a modified agreement has been reached, reset the expectations and begin the work necessary to meet the requirements of the new agreement.

7. Complete the agreement

Review the completed work with the other party to ensure that the terms of the agreement have been fully met. If not, negotiate what will be required to fulfill the agreement.

6.3 Manage Communication / Deliverables

Size	Information Needed
Small	<p>Status Reports can either be formal or informal on small projects. Typically a formal Status Report would be sent to the customer, while formal or informal Status Reports can be sent from team members to the Project Manager. If a formal report is sent, the format from a medium sized project can be used. If informal reporting is done, then the appropriate status information can be sent via email, voicemail, hand-written notes, etc.</p>
Medium	<p style="text-align: center;">(1) Deliverable: Status Meeting Agenda</p> <p>A Project Status Meeting with the project team or with the customer should follow a similar format.</p> <p>Accomplishments since last meeting.</p> <p>Overall status against Project Workplan (on schedule, ahead, behind)</p> <p>Follow-up on outstanding action items from previous meetings</p> <p>Discuss current issues (don't try to solve them here, use issues management)</p> <p>Discuss scope change requests (don't resolve them, use scope change management)</p> <p>Discuss potential risks in the future (don't try to solve them here, use risk management)</p> <p>Open discussion, questions</p> <p>Recap meeting and any action items</p> <p style="text-align: center;">(2) Deliverable: Project Status Report</p> <p>Project Name: The name of the project.</p> <p>Project Manager: The Project Manager on the project.</p> <p>Time Period: Give the date range for which this Status Report covers, for instance May 1 - May 31, 20xx.</p> <p>Project Description: A brief explanation of the project. Managers will tend to get multiple Status Reports. This helps them keep the right project in mind. This information only needs to be described once and then used in all subsequent reports.</p> <p>Status Summary: The top portion of the report should provide summary information regarding the overall project. This is a clue to the reader on the overall status. Make sure that the questions are worded in a way so that a project that is on-track will answer either all 'yes' or all 'no'.</p> <p style="padding-left: 40px;">Will the Project be Completed on Time?</p> <p style="padding-left: 40px;">Will the Project Complete Within Budget?</p> <p style="padding-left: 40px;">Will the Project Deliverables be Completed Within Acceptable Quality Levels?</p> <p style="padding-left: 40px;">Are Scope Change Requests Being Managed Successfully?</p> <p style="padding-left: 40px;">Are Project Issues being Addressed Successfully?</p> <p style="padding-left: 40px;">Are Project Risks Being Successfully Mitigated?</p> <p style="padding-left: 40px;">Are All Customer Concerns Being Addressed Successfully?</p> <p>Comment Summary: Give more information on any questions above that were answered 'no'.</p> <p>Significant Accomplishments This Period: List major accomplishments from previous reporting period.</p> <p>Planned Accomplishments for Next Period: List major planned accomplishments for the next reporting period.</p> <p>Additional Comments or Highlights Not Reflected Above: Describe any other comments that the reader should know that would not be reflected in the Status Report so far.</p> <p>Attachments: Any other attachments of interest to the reader. This could include:</p> <p style="padding-left: 40px;">Budget and Effort Hours Summary</p>

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	<p>Spending for the previous period. Spending on the project to date. Estimated total spending at project completion. Total project budget.</p> <p>Earned Value Issue Log Scope Change Log Project Workplan Project Metrics / Statistics Additional Company Reporting Requirements</p> <p style="color: blue;">(3) Deliverable: Individual Status Report (from team members to the Project Manager)</p> <p>Project Name: The name of the project. Team Member Name: The name of the person submitting the report. Time Period: Give the date range for which this Status Report covers, for instance May 1 - May 31, 20xx. Overall Status: List any overall concerns regarding your work, in terms of problems, scope change requests, risks identified, due date slippage, etc. Prior Period Accomplishments: List major accomplishments from previous reporting period. Planned Accomplishments: List major planned accomplishments for the next reporting period. Additional Comments or Highlights Not Reflected Above: Describe any other comments that the reader should know that would not be reflected in the Status Report so far.</p>
Large	<p style="color: blue;">(1) Deliverable: Status Meeting Agenda (same as for medium projects) (2) Deliverable: Project Status Report (same as for medium projects) (3) Deliverable: Individual Status Report (same as for medium projects) (4) Deliverable: Communication Plan</p> <p>The Communication Plan shows how best to communicate with all of the project stakeholders. Information on the Communication Plan includes the type of communication, who the communication is targeted to, how the communication will be delivered, the delivery frequency and who is responsible.</p> <p>** Find Communication Plan in Template Library **</p>

6.4 Manage Communication / Additional Workplan Activities

	Information Needed		
	Activity	Effort	Comments
Small	Create Individual Status Reports (optional)	1 hour	Weekly or bi-weekly. Team members send this status to the Project Manager.
	Create Project Status Reports	1-2 hours	Bi-weekly or monthly. Project Manager sends status to stakeholders.
	Attend Team Status Meeting	1 hour	Weekly or bi-weekly
Medium			
	Create Individual Status Reports	1 hour	Weekly or bi-weekly. Team members send this status to the Project Manager.
	Create Project Status Reports	1-2 hours	Bi-weekly or monthly. Project Manager sends status to stakeholders.
Prepared			
	Attend Team Status Meeting	1 hour	Weekly or bi-weekly
	Attend Status Meeting with Customer (optional)	1 hour	Weekly or bi-weekly. This meeting is scheduled if the customers do not attend the Team Status Meeting.

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	Attend Status Meeting with Customer (optional)	1 hour	Weekly or bi-weekly. This meeting is scheduled if the customers do not attend the Team Status Meeting.
Large	Activity	Effort	Comments
	Create Individual Status Reports	1 hour	Weekly or bi-weekly. Team members send this status to the Project Manager.
	Create Project Status Reports	1-2 hours	Bi-weekly or monthly. Project Manager sends status to stakeholders.
	Attend Team Status Meeting	1 hour	Weekly or bi-weekly
	Attend Status Meeting with Customer (optional)	1 hour	Weekly or bi-weekly. This meeting is scheduled if the customers do not attend the Team Status Meeting.
	Execute Communication Plan Activities	open	For each communication event / deliverable, add the appropriate activities to the Project Workplan . This includes assigning a person to do the work, start and end dates, etc. This ensures that the work around communication actually gets done.

7.0 Manage Risk

Definition: Risk refers to future conditions or circumstances that exist outside of the control of the project team, that will have an adverse impact on the project if they occur. In other words, whereas an issue is a current problem that must be dealt with, a risk is a potential future problem that has not yet occurred.

Successful projects try to resolve potential problems before they occur. This is the art of risk management. A reactive Project Manager tries to resolve issues when they occur. A proactive Project Manager tries to resolve potential problems before they occur. Not all issues can be seen ahead of time, and some potential problem that seem unlikely to occur, may in fact occur. However, many problems can be seen ahead of time. Risk management is a proactive process that is invoked to attempt to eliminate these potential problems before they occur, and therefore increase the likelihood of success on the project.

Note that there is a concept of opportunity risk or positive risk. In these instances, the Project Manager or project team may introduce risk, to try to gain much more value later. For instance, the team may spend time to relocate together because they think the close collaboration will result in productivity savings over the life of the project. This is an example of intelligent risk taking. However, in this step, it is assumed that the risks we are managing are negative risks. They need to be addressed so that the underlying potential problem does not occur.

7.1 Manage Risk / Process

7.2 Manage Risk / Techniques

7.3 Manage Risk / Deliverables

7.4 Manage Risk / Additional 'Build Workplan' Activities

7.1 Manage Risk / Process

The processes used to manage risk are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

Small Projects

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Small projects usually do not have much risk. Remember that risk involves problems that may occur in the future. Since small projects usually do not have a long duration, there is not as much opportunity for future problems. If the Project Manager knows of future project risk, then the risk procedures for medium projects can be used.

Medium Projects

Define the Project

1. When you are defining the project, perform a complete assessment of project risk. The Project Manager can take an initial draft based on what they know and circulate it for adds/changes/comments. Another technique is to gather all the key stakeholders and discuss potential risks during a facilitated meeting. See 7.2 Manage Risks / Techniques and 7.2.1 Manage Risks / Risk Factors for further help defining risks.
2. Assign a risk level to each risk identified. The risk level should be high, medium, or low, depending on the severity of impact and the probability of the event occurring. Use the following table as a starting point. For instance, the highly likely / high impact factors are obviously high risk. However, if you have an event that is not likely to occur, but the impact, if it occurred, would be devastating (i.e. someone could get killed), you would still want to consider it a high risk and put together a risk plan accordingly.

Severity of Risk Impact / Probability of Risk Occurring	Overall Risk Level
High negative impact to project / Highly likely to occur	High
High negative impact to project / Medium likely to occur	High
High negative impact to project / Not likely to occur	Medium / Low
Medium negative impact to project / Highly likely to occur	Medium
Medium negative impact to project / Medium likely to occur	Medium / Low
Medium negative impact to project / Not likely to occur	Low
Low negative impact to project / Highly likely to occur	Low
Low negative impact to project / Medium likely to occur	Low
Low negative impact to project / Not likely to occur	Low

3. For each high-level risk that you identified, create a plan to ensure that the risk is mitigated and does not occur. This plan should include steps to mitigate the risk, people who are assigned, completion dates and periodic dates to monitor progress. There are five major responses to a risk - leave it, monitor it, avoid it, move it to a third party or mitigate it. For further information on these alternatives see 7.2 Manage Risks / Techniques.
4. Evaluate the medium-level risks to determine if the impact is severe enough that they should have a risk mitigation plan created for them as well. If the impact is severe enough, put together a risk plan for them as well.
5. Look at any low risk items, and see whether they should be listed as assumptions. In this way you recognize that there is a potential for problems, but because the risk is low, you are 'assuming' that the condition will not occur. See 7.1.1 Manage Risk / Assumptions for more information.
6. Move the activities associated with the risk plans to the **Project Workplan**. Moving the activities to the workplan should help ensure that the work is actually completed and keeps the workplan the primary focus of all work planning and monitoring.

Manage the Project

7. The Project Manager needs to monitor the risk plans to ensure they are being executed successfully. If it looks like the risk is not being mitigated successfully, new risk plan activities should be added.
8. Second, the Project Manager also needs to periodically evaluate risks throughout the project based on current circumstances. New risks may arise as the project is unfolding and some risks that were not identified during the

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Define Project step may become visible at a later date. This ongoing risk evaluation should be performed on a regular basis, say monthly, or at the completion of major milestones.

Large Projects

The risk management process for large projects is the same as for medium projects, with one additional item. For every high and medium risk where the Project Manager is creating risk mitigation plan, also create a contingency plan, to document the consequences to the project if the risk plan fails and the risk actually occurs. In other words, identify what would happen to the project if the future risk turns into a current issue. This helps the Project Manager ensure that the effort associated with the risk plan is proportional to the potential consequences. For instance, if the consequence of a potential risk occurring is that the project will need to be stopped, this should be a strong indication that the risk plan must be aggressive and comprehensive to ensure that the risk does not occur.

7.1.1 Manage Risk / Assumptions

Assumptions are very much related to risk, and, in fact, are simply low-level risks. Let's take a common statement that is included in many **Project Definitions** - the resources needed for this project will be available when needed. What kind of a statement is this? Most people would say it is an assumption. After all, when a project starts, we always assume we will get the resources we need.

However, is it really an assumption? Can you imagine starting a project where the people and equipment were not available, and in fact there was a realistic possibility that they would not be ready when you need them - perhaps because another project needed to finish first. It is not too difficult to imagine. In that case, the same statement would definitely be a risk, not an assumption.

The key point is that the same statement might be an assumption or a risk, depending on the circumstances of your particular project. There is some degree of uncertainty to an assumption. The difference between an assumption and risk is whether you think there is a high or low likelihood the event will happen. If the event is negative and there is a low probability that it will happen, it can be stated as an assumption. If the event is positive and there is a high likelihood it will happen, it is also an assumption. One way to identify important assumptions is to perform a risk assessment (7.2.1 Manage Risk / Risk Factors) and look at all the low risk items. Most of these low risks are not worth mentioning, but some will have significant implications if events do not turn out as you think. These are the ones that you can document as assumptions.

If the event does not have uncertainty, that is, there is a 0% or 100% chance that the event will occur, and then it is not an assumption or a risk. It is simply a fact (100%) or fiction (0%). Assumptions and risks are also outside the control of the project team. If the event is within your control it is neither an assumption nor a risk. It should simply go into your workplan. Let's look at the following examples.

Statement	Assumption, Risk or Other?
We will have strong support for this initiative from our executive sponsor.	Can't tell if it a risk or an assumption. Depending on the project, there could be a high degree of risk in this statement (risk) or very little (assumption).
The production and test servers will be installed before we are ready for integration testing	Can't tell if it a risk or an assumption. Depending on the project, there could be a high degree of risk in this statement (risk) or very little (assumption).
The concrete floor is 12 inches deep.	This statement is a requirement, and not a risk or assumption. It describes a deliverable.
We will complete requirements before we begin design work.	This is part of the project approach or workplan. It is not a risk or assumption because it is within the control of the project team.
Our vendors will be ready to interface with our application by October 1	Can't tell if it a risk or an assumption. Depending on the project, there could be a high degree of risk in this statement (risk) or very little (assumption).
We must go to the moon to get the supply of meteor fragments that this project requires.	This is not a risk or assumption because there is no risk involved. It is either a fiction (0% true).

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The car must be able to withstand the force of a collision at 40 miles per hour.	This statement is a requirement, and not a risk or assumption. It describes a deliverable.
It takes 60 minutes to drive from one project team location to the other.	This is not a risk or assumption because there is no risk involved. It is either a fact (100% true).

7.2 Manage Risk / Techniques

Manage Risk: Alternatives Strategies for a Risk Plan

Once risks have been identified, there are a number of options that the Project Manager might consider for responses.

1. **Leave it:** In this approach, the Project Manager looks at the impact the risk condition would have on the project and decides that nothing needs to be done to mitigate the risk. This approach should only be used for low impact risks, or those that are unlikely to occur. This approach is dangerous for high and medium risks.
2. **Monitor the risk:** In this case, the Project Manager does not proactively mitigate the risk, but monitors it to see whether it is more or less likely to occur as time goes on. If it looks more likely to occur, then the team must mitigate it at a later time. This approach can work for serious risks that are not likely to occur. Rather than put a plan in place immediately, the Project Manager creates a plan only if it looks likely that the risk will occur. The advantage is that scarce resources are expended only on those risks that are likely to occur. The disadvantage is that the delay in addressing the risk might make it less likely that the risk can be successfully mitigated in the future.
3. **Avoid the risk:** Avoiding the risk means that the condition that is causing the problem is eliminated. For instance, if a part of the project has high risk associated with it, then the whole part of the project is eliminated. Risks associated with a vendor might be avoided if another vendor is used instead. This is a very effective way to eliminate risks, but obviously can be used only in certain unique circumstances.
4. **Moves the risk:** In some instances, the responsibility for managing a risk can be removed from the project by assigning the risk to another entity or third party. For instance, outsourcing this function to a third party might eliminate installation risks. The third party might have particular expertise that allows them to do the work without the risk. Or, even if the risk is still present, it now is up to another party to resolve.
5. **Mitigate the risk:** In most cases, this is the approach to take. If a risk has been identified and is a concern to the project, usually proactive steps must be taken to ensure that the risk does not occur. Another of the goals of mitigation is to ensure that the effect (impact) of the risk is minimized if it does occur. For the purposes of the SPS Project Management Process, it is assumed that risk plans are established to mitigate the risk.

The Customer Does Not Expect Zero Risk

Everything in life has some degree of risk. Walking across the street can be risky. In the same way, customers do not expect their projects to be risk free either. Make sure that you work through a risk evaluation with the project team and the customer. If you are lucky, you may find that all the risks are low risk. However, this exercise will alert the customer and the project team to those medium and high-level risks that may cause future problems. Risks should be surfaced ahead of time. The first time is before the project starts. Then risk identification should occur throughout the project on an ongoing basis. There is no reason to hide or shy away from the exercise - the customer does not expect the project to be risk free.

Is Risk Inherently Bad?

Risk is not necessarily bad, since it is a feature common to all projects. All projects have some degree of uncertainty due to the assumptions associated with them and the environment in which they are executed. Although the risks cannot be eliminated entirely, many can be anticipated and resolved ahead of time. The purpose of risk management is to identify the risk factors for a project and then establish a risk management plans to minimize the probability that the risk will materialize.

There must be Some Uncertainty to a Risk

If an event is identified as a potential risk, there has to be some level of uncertainty involved. In other words, if an event has a zero percent likelihood of occurring, then it would not make sense to identify it as a risk. It is not even a low risk. It is not a risk at all. On the other hand, if an event is 100% certain to occur, then it is not a risk. It is not even a high risk. It is a fact. (Sometimes these 100% events are also called constraints. A constraint is a fact that that impacts your project that must be planned around. For instance, you may not be able to get a resource you need until 30 days after the project starts. This is a

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constraint.) Without getting into fractions, a risk has between 1% to 99% chances of occurring. If an event has a zero percent chance of occurring, then it should be ignored. If it has a 100% chance of occurring, then it is a fact (and perhaps a constraint). When practicing risk management, be sure to focus on the risks and not on facts and non-events.

Distinguish Between Risks, Causes and Effects

There is a cause for every risk, and an effect if the risk occurs. When the project risks are identified, make sure that the risk itself is noted, and not the cause or effect of the risk. The cause is a situation that exists that sets up a potential risk. In general, the cause is a fact or a certainty for the project. On the other hand, the effect is the likely outcome if the risk occurs. Look at the following example.

A solution needs to be implemented in all of a company's worldwide locations, including those in developing countries. If the telecommunications lines are not upgraded on time where necessary, the solution will not be viable in those locations.

In the previous example, what is the risk?

- Is it that we have to implement the solution in developing countries? **No**, that is the cause. It is a fact, or a requirement.
- Is the risk that the solution will not be used in certain countries? **No**, that is the potential effect of what might occur in this scenario.
- Is the risk that the necessary telecommunications upgrades are not performed on time? **Yes**, this is where the uncertainty lies.

Risk Factors

Sometimes it is not easy to look at a project and know whether or not there are risks. However, there are some project characteristics that are inherently more risky than others. For instance, a project with 20 team members is more risky than a project with five team members. There is increased risk with increased communication, increased collaboration, increased information sharing and increased people management. A summary list of other risks to consider is in 7.2.1 Risk Factors.

Budgeting for Unknown Risks

For medium to large projects, it can make sense to include time and budget for unknown risks as a part of your estimating process. This would especially make sense for projects that have a number of high-risk events. If you do an effective job of periodically reassessing risks, you may find new risks to mitigate that were not included in the original budget. There is some industry evidence that a 5% contingency can be added to the project for dealing with risks that are unknown when the project starts. (The time to mitigate and manage known risks should be included in the original estimate.)

Risk Identification Can be a Team Effort

If team members are familiar with the circumstances of the project, they can take an active role in identifying and evaluating project risks. Joint participation can help identify project risks, lay out effective actions to manage the risk and provide consensus and buy-in for execution.

Weigh the Cost of the Risk Plan Against the Level of Risk

All projects have some risk, and risk plans come at a cost. Make sure that the effort and cost associated with managing the risks do not exceed the cost to the project if the risk occurs. For high risks, this is normally not the case. However, if you are managing medium to small risks, make sure that the costs and benefits make sense for the project.

Excuses to Use if Risks Are Not Managed Successfully

The Project Manager may find that it is hard to find the time to evaluate and manage risks, since there are so many more urgent things to deal with. It may also be hard to motivate customers and team members to deal with risks. However, one of the responsibilities of the Project Manager is to maintain focus on risk management, since it is much more effective to eliminate these potential problems ahead of time, rather than having to resolve the issues when they arrive. In fact, if you are not going to manage risk effectively you should be prepared to utilize the following behaviors instead.

- Add unjustified padding to your estimates to cover the cost and effort associated with unmanaged risks
- Prepare ahead of time for whom to blame if things go wrong

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- Be prepared to beg forgiveness by stating you were too busy focusing on delivering results to worry about future events
- Discuss how you are not a fortune teller, and that the risk could not be foreseen
- Act casual and say that 'risk happens' - there is nothing you can do about it.
- Eliminate other project management or team infrastructure items to make up for having to solve the problems when they arise. This includes eliminating quality management steps, testing, training, communication, etc.

7.2.1 Manage Risk / Techniques / Risk Factors

The following checklist can be used to determine whether there are risks on your project that you have not considered. Use this information as a guideline only. Other project factors will come into play as well. For instance, an experienced Project Manager can mitigate many risks associated with large project size. Also remember, if your project falls into a high-risk category, it does not mean you will not be successful. It only means that you should put a plan into place to manage the risk.

This table identifies characteristics that may imply risk, as well as criteria for knowing if it is high-risk and low-risk. Depending on where your project characteristics fall, you can evaluate whether your risk is high, medium or low. (Medium risks fall in between the extremes.) Note that this checklist represents a generic organization. This type of checklist can be especially valuable if the organization documents the risk characteristics and risk criteria in its own organization and makes them available to all Project Managers. Your checklist should include characteristics specific to your company, your organization, your projects and your company culture. For instance, you may find in your organization a project of less than 5000 hours is considered low risk, while one that is 20,000 hours or more is high risk.

Characteristic	High Risk	Low Risk
Total effort hours	Large project > 5000 hours	Small project < 1000 hours
Duration	Longer than 12 months	Less than 4 months
Team size	Over 8 members	Fewer than 4
Number of customers or customer organizations	More than three	One
Project Scope / deliverables	Poorly defined	Well defined
Business benefit	Not clear	Well defined
Project team and customer business knowledge	Neither the project team nor the customer have solid business knowledge	Both the project team and the customer have solid business knowledge
Requirements	Very complex, hard for customer to define	Easy for customer to define
Dependency on other projects or outside teams	Dependent on three or more outside projects or teams	No more than one dependency on an outside project or team
Project Sponsorship	Unknown (should not start the project)	Identified and enthusiastic
Customer commitment	Unknown, passive	Passionate

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Changes required for existing procedures, processes and policies	Large amount of change	Little change
Organization structures	Large amount of change	Little or no change
Project Manager experience	Little experience on similar projects	Similar experience on multiple projects
Physical location of team	Team is dispersed at several sites	Team is located together
Use of formal methodology	Large project / no formal methods or processes	Small project / standard methods in use
Technology	New technology is being used for critical components	No new technology required
Response time	Very small response times are critical	Normal response time is acceptable
Data quality	Data is of poor quality	Data is of good quality
Vendor partnership	Have not worked with the vendor before	Have a good relationship with the vendor

7.3 Manage Risk / Deliverables

Size	Information Needed
Small	There are no risk management deliverables for small projects.
Medium	<p style="text-align: center;">Deliverable: Risk Plan</p> <p>Risk Factor: What is the identified risk to the project?</p> <p>Risk Impact to Project: Identify the overall impact to the project in terms of high, medium and low.</p> <p>Risk Probability: Determine the probability that the risk event will occur.</p> <p>Risk Level: An overall designation of high, medium or low, depending on the impact to the project and the probability that the risk will occur.</p> <p>Risk Plan: What are the activities to be performed to manage the risk and ensure it does not occur?</p>
Large	<p style="text-align: center;">Deliverable: Risk Plan with Consequences</p> <p>Risk Factor: What is the identified risk to the project?</p> <p>Risk Impact to Project: Identify the overall impact to the project in terms of high, medium and low.</p> <p>Risk Probability: Determine the probability that the risk event will occur.</p> <p>Risk Level: An overall designation of high, medium or low, depending on the impact to the project and the probability that the risk will occur.</p> <p>Risk Plan: What are the activities to be performed to manage the risk and ensure it does not occur?</p> <p>Consequences: Note the consequences to the project if the risk plan fails and the risk actually occurs. At that point, the risk will be an issue instead, and will be dealt with through issues management.</p>

7.4 Manage Risk / Additional Workplan Activities

These activities are added to the workplan for monitoring and managing risk. It is assumed that the initial activities for identifying risks were completed during the Define Work step.

Size	Information Needed
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Small	There are no additional workplan steps for small projects.		
Medium Large	Activity	Effort	Comments
	Add all Risk Plan activities to the Project Workplan	open	After the Define Project step, add the activities to the workplan, along with start and end dates. Assign resources to all activities.
	Review Status of Risk Plans	1-2 hours	Weekly or bi-weekly. Always assigned to the Project Manager. Use this time to ensure progress is being made on all Risk Plans , and that you are successfully managing future risks.
	Evaluate project for new risks	1 hour	Monthly. Take a step back and evaluate where the project is going to determine if there are any new risks that should be identified and managed.

8.0 Manage Documents

This step discusses the storing and sharing of electronic and paper documents. The larger a project is, the more difficult it becomes to smoothly share information between all the team members and stakeholders. This is especially true when more than one person works on large deliverables. At a broader level, this concept is a part of knowledge management. If the project manager does not think about these processes ahead of time, the project will end up with problems finding relevant information and frustration dealing with inconsistent formats of deliverables. This will end up requiring extra effort re-doing work that was already completed.

In general, this idea of document management is similar to what is done with computer source code management. The management of source code should be done under the direction of a software change management tool, or a database that keeps track of ownership and versioning. Without these types of tools, it would be impossible to develop and support large software projects.

A couple examples will help explain this concept. Let's say your project is going to create many documents that need to be stored and shared - for instance, the Project Definition, Issues Log, Business Requirements, testing Plan, etc. After the document is created, where will it be stored? Will you place it in file folders, document management software or a groupware database? Who will have access to the documents? What will the naming convention be? Let's say the Project Definition is updated. Will the new document have a different name than the older one? For instance, will the new document be called version 2? These are all part of your document management procedures.

Another great example is for status reports. If every team member sends a status report to the project manager, what will the naming convention be? Should it be in the format of 'Date / Name / Status Report'? Or should it be 'Name / Status Report / Date'? In the first case, the status reports will all sort together by date. In the second case, they will sort by name.

The last example is to think about complex documents that will go through a review process. Should project deliverables go through a process for drafts / awaiting approval / approved? How will everyone know when a document has been approved so that they do not mistakenly think that an early draft is the final version?

All of these considerations, and more, are a part of the document management process. These considerations are trivial for small projects. For large ones, these processes need to be planned ahead of time, or else confusion, uncertainty and extra work occur when the project is in progress.

8.1 Manage Documents / Process

8.2 Manage Documents / Techniques

8.3 Manage Documents / Deliverables

8.4 Manage Documents / Additional 'Build Workplan' Activities

8.1 Manage Documents / Process

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The processes used to manage documents are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

First of all, the Project Manager should understand the process that a document goes through from creation to approval. This is explained in 8.1.1 The Document Life Cycle.

Small Projects

Although small projects have fewer problems managing documents, some of the processes and infrastructure for managing documents may still be relevant to them. For instance, even a small project will need a common repository or directory structure to store project deliverables. Each Project Manager can evaluate their own project to see which areas might make sense to define. There is a technological component to this area as well. If document management software is used, it may facilitate and help resolve many of these definition questions, and it may define certain procedures for updating information.

Unless your small project is part of a larger project or program, you normally don't need to be concerned with document management. The Project Manager can still review the document management aspects of larger projects below to see if there are some that make sense to apply.

Medium / Large Projects

The larger the project, the more rigor and structure are needed to manage documents. The following sections describe various aspects of document management that must be considered and planned for. If you do not think through a good document management plan ahead of time, you can end up with a big mess trying to save and find documents. The following sections describe various aspects of document management that must be considered and planned for.

Document Repository: Decide where the project documents will be stored. This could be a file directory, document software, groupware, paper file cabinet, etc. A sample logical repository structure is available at 8.3 Manage Documents / Deliverables.

Logical / Physical Organization: What is the organization of the document repository? First lay out a logical view of what the structure will look like. Then determine how to implement it physically in a directory or tool. The structure should be one that is easy to understand and easy to use to find relevant information. (See Deliverable Section for an example.)

Document Tools: What standard document tools will be used? Don't have half of the team using Word and half using WordPerfect. Similarly, all team members need to have the same spreadsheet software. If you are using a tool for the project workplan, everyone who needs access should have the same software. Once the standard software is identified, also make sure that the entire team is on the same release. In other words, if you are using Word 2000, make sure all team members have Word 2000. Sometimes your documents will not be able to be shared if the creator and the reader are not on the same software release.

Access Rules: Who will be able to access the documents? Who can update them? Who can read them? Even if you are using ordinary folder structures, you can still establish clear rules. For instance, you could set up a folder for final, approved document that no one should touch. You can also establish work folders for each team member where they can put all their documents that are in progress, and anything else they want.

Repository Librarian: Who will be responsible for managing the document repository? Will they have a backup? In large projects, this may be a full-time role, although someone with a clerical background may fill it. The responsibilities of the Librarian are as follows:

- Coordinate activity around the Document Repository
- Establish, maintain, and enforce Document Repository standards and monitor them for conformance
- Identify / resolve Repository problems
- Monitor and control access and updates to the Repository
- Determine when it is necessary to archive old documents in the Repository, and perform archive and purge functions.

Keywords/Indexing: Depending on the technology of your repository, it should be possible to search for documents. The search can usually be performed by document name (making naming standards more important) and/or by keyword. Keywords are descriptive words that are associated with the document so that someone can find it by a keyword search if they do not know the name or where it is located. The keyword and searching capabilities should be defined up-front. Examples of a

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simple document-indexing scheme would include the document title, subject, author or contact person, submission date and a list of keywords. The document would then be able to be found using any of the above indexing or keyword searches.

Naming Standards: After the organization is established, define the naming standards. This will keep information from being misplaced or stored in the wrong place. For instance, within a **status report** folder, the naming convention might be '20001201 Joe Smith Status Report'. In this scheme, all the **status reports** for a given period would sort together. On the other hand 'Joe Smith 20001201 Status Report' groups the reports by person. The Project Manager and the Repository Librarian will ensure that everyone is using the same naming scheme. Although this exercise might seem tedious, having a common naming standard for related documents will be very valuable as your project team generates hundreds of documents over time.

Versioning: Will prior documents be saved if they are updated, or will only the most current version be stored? Many documents, such as the **Project Definition**, should have all approved versions saved. For these documents, the naming convention will need some type of version number, for instance, 'ABC Project Definition v 1'. With this type of naming convention, it is relatively easy to ensure that everyone is looking at the most recent version.

Document Status: When documents need to be approved, and especially if the approval process can be lengthy, it is important to signify what document approval status. For instance, it is important to know whether a deliverable you are reading is a final approved version, or a draft. Having separate libraries for documents as they go through the approval process can do this. Typical document indicators are 'draft', 'awaiting approval' and 'approved'. When a document is being created, it is in draft mode. When the document is being circulated for approval, it is moved to the awaiting approval folder. When the document is approved, it is moved to the approved folder. Another alternative is to place non-approved documents in a folder (directory), and the final approved document in the repository.

Retention/ Purging: Purging old documents ensure that the information on the repository is relevant. For instance, weekly individual Status Reports may not be needed after three months. On the other hand, the Project Definition document is probably needed for the life of the project, even if it is 12 months old. At periodic times during the project, the Repository Librarian can archive any information that is no longer relevant and purge the documents from the repository.

Backup: If the document repository is not backed up automatically, the Project Manager needs to put activities on the workplan to ensure that the backup is performed. If systematic processes are backing up the repository, make sure that the frequency of the backup is adequate to allow recovery of as up-to-date documents as possible. Make sure to specify where the backup is stored, and for how long. At least one recoverable backup of the document repository should be sent off site in case of a disaster.

Standard Document Format: It is easier in the long run to read and create documents if they all follow a standard format. For instance, the project team should agree on a standard font and font size for all documents. In addition, create standard headers and footers; cover pages and table of contents. This will give all the documentation a standard look and feel.

Repository Periodic Review: If your project is very large and the document repository is very complicated, it may make sense to perform a scheduled, periodic review of the repository and the overall document management processes. The Librarian will be responsible for coordinating this review. The review can check for the following:

The repository is being properly backed up and purged.

Documentation is being stored in the right place.

Documents are being indexed and categorized properly so that they can be accessed when needed.

Documents are being added on an ongoing basis, or at least at the end of every major phase.

Repository Update Procedure: The project team needs to decide whether updates to the repository will be controlled, or whether everyone will have update access. If everyone has the ability to update, there will be a tendency for the quality and consistency of the information to be degraded. Obviously, controlled access involves some type of procedure. If update access is controlled, then typically only the Librarian, and a backup, can update or add documents. A procedure to support this is:

- Team members submit documents to the Librarian when they have been given final approval, or at the end of every phase and the end of the project. The team member completes a form that describes the deliverable, the keywords, approval date, storage folder etc.
- The Librarian ensures that the document is appropriate for the repository, and that it follows project standards. If it is not appropriate, or if it does not follow standards, the document is returned to the team member for correction.

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- If the document is relevant and follows document standards, the Librarian places it into the proper folder of the repository, and updates any other required information. The Librarian uses the information on the form to properly place the document in the repository.

8.1.1 Manage Document / The Document Life Cycle

When a team member says they can complete a document in two weeks, are they saying that document will be ready to circulate in two weeks, or that the document will be completed and totally approved in two weeks? It is important for the Project Manager to recognize the stages that a document must go through from creation to completion. These steps should be built into the workplan. Not all documents need to go through all the stages of document creation and approval. However, depending on the document, one or more of the steps will be required. Some of the review steps defined here would also be considered part of a quality control process for the documents.

The Document Life Cycle

1. **Initial Document Creation:** In this step, the document is created initially. If there are no subsequent reviews, then this step results in the creation of the final deliverable. Most of the effort hours associated with the document are used in this step. Subsequent steps may take a long duration, but they do not take nearly as much effort.
2. **Feedback and Modification (Iterative):** These two steps involve circulating the document for initial review and feedback. Based on the review comments, the document is updated. Depending on the particular document, this may be an iterative step. A document may have an internal review, followed by a stakeholder review, followed by a management review. After each of these reviews, the document is subsequently modified based in the feedback and sent to the next step.
3. **Approval:** When the document has been circulated for feedback and subsequently updated, it will be ready for final approval. Some documents should be formally approved in writing. Others are simply considered complete after the final round of feedback is received.

Like all completed (production) deliverables there may be subsequent updates that may require their own feedback / modification / approval cycles as well.

8.2 Manage Documents / Techniques

Technology

Much of the information in this section is influenced by the technology being used on the project. For instance, document management software will usually come with a standard logical structure. You just plug in your specific names to make it real. Software may also enforce versioning, update authority and may specify what other information is needed. However, regardless of the technology, review section 8.1 to ensure that you have thought through the document management process, even if some of it is handled by software.

Project and Project Management Documents

It may be obvious, but the document repository holds all the project deliverables - both project related and project management related. For instance, the repository will hold the **Project Definition** and **Project Workplan** (project management deliverables), as well as the Technical Design and Testing Plan (project deliverables).

After the Project - I

After the project has completed, some of the documents may be archived, while others need to be maintained indefinitely. For instance, **Project Status Reports** can be archived (or purged) when the project has completed, since they are time sensitive and have limited value after the project. A Users Manual needs to be saved. These saved documents can continue to be updated in the repository, unless the company has another central database for these types of deliverables.

After the Project - II

Some companies maintain a central repository of major project deliverables that can be leveraged for reuse. For instance, the Business Requirements document that was created for your project may be able to be leveraged by another project that is looking into a similar business area. The Testing Strategy your project defined may be able to be reused by another project with

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similar testing needs. So, after the project, see what information can be leveraged on future projects and whether there is a company-wide repository where the documents can be submitted.

Work area

Usually the repository does not hold document versions that are currently being worked. (This may also depend on any document software being used.) Each team member should have a work area where they can store versions that are being worked on now. This can be a directory structure or a folder that you have update/create/delete access to. Each team member can structure their work area in whatever way makes sense to them.

Draft Copies

Draft copies are documents that have been initially completed by the author, but are not yet ready to be considered entirely complete from a project perspective. In most cases, this is because the document is in some kind of review process. On most projects, draft copies of documents would be stored in the author's work area. However, for large projects, or ones where more rigor in document management is needed, it will make sense to maintain a library or folder for draft copies, and to maintain it separately from the library of completed documents. In this case, the process would look as follows:

1. A document would still be created and edited in the author's work area.
2. After the initial draft is completed, the document is moved from the work area to the draft library. The document stays there until the author needs to update it or it is ready to be moved to the repository.
3. If the draft copy needs to be updated again (say, based on further review and input), the document is copied back to the work area for updating, leaving a copy in the draft library.
4. When the update is complete, the document is moved back to the draft library.

This process is repeated until the document is totally complete. Then the document can be moved from the draft library to its final location in the completed deliverable library. The value in this approach is that the project team always has one and only one official draft of each document, and only one live, approved version as well.

8.3 Manage Documents / Deliverables

Size	Information Needed
	Deliverable: Deliverable Submission Form Document Title: What is the name of the document? Document Abstract: A brief description of the document. Used for people doing retrievals to quickly determine if the document is relevant or not. Author: Who wrote the document? Approval Date (if applicable): The date the document was approved. Keywords: What words or phrases would a person want to search on to find this document? In many cases, the list of keywords can also be standardized. Document: The document itself should be attached or accompany the request form.
Small Medium Large	Deliverable: Repository Logical Design At a high level, the document repository should be comprised of three main areas - Project Deliverables, Project Management Deliverables and Reference. If the technology allows, a fourth area can be defined for the Work area. Project Deliverables - Directory for storing all project related deliverables. Project Management Deliverables - Directory for storing all project management related deliverables. Reference - Directory for any documents which add value and are used as input to the project, such as architecture definition, customer organization, training material, graphics, etc. (Deliverables that are created by the project do not go here.)

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	Work Area (optional) - Directory for each team member to use to create work products.	
	<i>Below is an example of how the logical design could be laid out using a simple directory structure.</i>	
	Directory Structure for a \Project	
	\Project Deliverables	
	\Final \Draft \Work in Progress	
	\Project Management Deliverables	
	\Project Definition \Communications \Presentations \Financial Information \Logs \Miscellaneous \Workplans \Status	
	\Meeting Minutes \Reports	
	\Reference	
	\Tutorials \Templates \Other Reference Material	
	\Work area	
	\Resource 1 \Resource 2 (.....)	

8.4 Manage Documents / Additional Workplan Activities

Size	Information Needed		
	Activity	Effort	Comments
Small Medium Large	Establish the Document Repository.	open	Use this time to establish the repository and define the logical and physical layout. There may be investigation and recommendation of tools and there may be training required as well.
	Add activities to define the other areas in the 8.1 process section.	open	After the Define Project Step, add work for creating naming conventions, defining common document standards or templates, determining versioning standards, ensuring everyone has common document creation software and versions, etc.
	Evaluate Document Management Process	1-2 hours	On a monthly basis, evaluate the use of the document management processes established to determine if they are still relevant. As the project progresses, you may find that current procedures or standards need to be revised and that new ones need to be defined.

9.0 Manage Quality

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Definition: Quality is ultimately defined by the customer, and represents how close the project and deliverables came to meeting the customer's requirements and expectations.

The old adage about quality being in the eyes of the beholder is true. Your customer ultimately measures quality. Our goal is to meet the customer's requirements and expectations. This is a critical point. Sometimes there is a tendency to think that 'quality' means the best material, the best equipment and absolutely zero defects. However, in most cases, the customer does not expect, and cannot afford, a perfect solution. If there are just a few bumps in the project, the customer can still say that the project delivered to a high level of quality. On the other hand, a flawlessly designed, defect-free solution that does not meet the customer's needs is not considered high quality.

The purpose of the quality management step is to first understand the expectations of the customer in terms of quality, and then put a proactive plan and process in place to meet those expectations.

Since the customer defines quality, it may seem that it is completely subjective. However, there is a lot about quality that can be made objective. This requires first breaking down the generic term of 'quality' into a number of areas that define the characteristics of quality. Then, look at each of the individual characteristics and determine one or more metrics that can be collected to mirror the characteristic. For instance, one of the features of a quality solution may be that it has a minimum amount of errors. This characteristic can be measured by counting errors and defects after the solution goes live.

Quality management is not an event - it is a process, and a mindset. A faulty process cannot produce a consistently high quality product. There needs to be a repetitive cycle of measuring quality, updating processes, measuring, updating processes, etc. To make the quality management process work, collecting metrics is vital. So, Steps 9.0 and 10.0 of the SPS Project Management Process are closely tied. If you want to do a good job managing quality, you need to be measuring. If you are not going to capture metrics, then it will be hard to improve processes through a quality management initiative.

One of the purposes of quality management is to find errors and defects as early in the project as possible. Therefore, a good quality management process will end up taking more effort hours and cost up-front in the project. However, there will be a large payback as the project progresses. For instance, it is much easier to spot problems with the business requirements during the analysis phase of the project, rather than have to redo work to fix the problems during the testing. It is also much cheaper to find a problem with a computer chip when the chip is manufactured, rather than have to replace it when a customer brings the computer in for service after a purchase. In other words, the project team should try to maintain high quality and low defects during the deliverable creation processes, rather than hope to catch and fix problems during testing toward the end of the project (or worse, have the customer find the problem after the project has been completed.)

9.1 Manage Quality / Process

9.2 Manage Quality / Techniques

9.3 Manage Quality / Deliverables

9.4 Manage Quality / Additional 'Build Workplan' Activities

9.1 Manage Quality / Process

The processes used to manage quality are described in this section. These processes can be modified as necessary for your project, and then inserted into the **Project Management Procedures** document that is created during the 1.0 Define Work step.

Before the overall quality process can be defined, a brief explanation is given to provide a common definition for quality control and quality assurance.

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Quality Control refers to the activities associated with the creation of project deliverables. It is used to verify that deliverables are of acceptable quality and that they meet the completeness and correctness criteria established in the quality planning process. Quality Control is conducted continually throughout a project and is the responsibility of team members and the Project Manager.

Quality Assurance does not refer directly to specific deliverables. It refers to the **process** used to create the deliverables. In general, quality assurance activities focus on the processes being used to manage and deliver the solution, and can be performed by a manager, customer or a third-party reviewer. For instance, an independent project reviewer might not be able to tell if the content of a specific deliverable is acceptable or not. However, they should be able to tell if the deliverable seems acceptable based on the process used to create it. They can determine, for instance, whether reviews were performed, whether it was tested adequately, whether the customer approved the work, etc.

Small Projects

Small projects are not active for long enough that the work processes can be updated to make them of higher quality. Therefore, small projects should just be concerned about quality control steps. Each deliverable produced should be reviewed and approved. The final review (perhaps the only one) is with the customer. The review will focus on the overall quality of the deliverable. If the deliverable can be tested, the review will also discuss the testing procedure used.

Medium Projects

1. Develop a **Quality Plan** as a part of the overall **Project Management Procedures** document created in Step 1.0. This **Quality Plan** will identify the major deliverables, completeness and correctness criteria, quality control activities and quality assurance activities. Again the rule is to do more planning and analysis up front. The **Quality Plan** allows you to understand when the deliverables are completed, as well as how to prove they are correct. It is also the place to think about what processes will be put into place to ensure that quality deliverables are produced.
2. Move the quality control and quality assurance activities onto the **Project Workplan**.
3. During the project, ensure that the quality control activities for every deliverable are performed. One of the major ways to ensure quality deliverables is to perform deliverable reviews. These can be formal and informal. The general process for formal deliverable reviews is defined at 9.1.1 Deliverable Review Process.
4. During the project, conduct the quality assurance activities as specified in the **Project Workplan**.
5. (Optional) At the end of each project, provide feedback to the organization on the quality process and the metrics captured. These can be leveraged by the organization for an organization wide metrics program and provide input into best practices that can be used again. If the organization does not leverage this information, or collect standard project metrics, then this step is bypassed.

Large Projects

First of all, large projects should start with the same quality management process that is defined above for medium projects, including quality planning, quality control and quality assurance. In addition, large projects have enough duration that process improvement can be put into place to raise the quality of the deliverables and the deliverable creation process. This is where metrics come into play.

Note: If the Project Manager is identifying and capturing metrics as a part of Step 10.0 - Manage Metrics, then the following activities can be done as part of that step. However, if no other metrics are being captured, then execute these activities to at least collect some information for quality process improvement.

1. Identify a set of metrics that can be gathered that will provide insight into how the project is going, and how the deliverable creation process is working. The Project Manager should already be capturing overall financial and duration metrics. Now the metrics need to be more sophisticated. There are two areas where you are trying to manage quality - in your project work processes and in the actual deliverables you are building. Try to capture metrics that will measure each. Examples of process metrics include:
 - Customer satisfaction with project team communication
 - Amount of rework due to faulty or missing analysis
 - The amount of time spent on issues resolution

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Examples of deliverable or product metrics include:

- Number of major errors uncovered during testing
- Response time of a computer application you are building
- The time it takes for a product to fail

(Additional information on metrics is found in Step 10.0 Manage Metrics)

2. During the project, capture the metrics. Most should be captured monthly. Some, like customer satisfaction surveys, may be captured quarterly. If you are building or manufacturing something tangible, you may want to collect metrics every day.
3. Analyze the metrics to determine how the project work processes can be improved. For instance, the deliverable review process might be changed to include an initial review when the deliverable is 50% complete. The time required for this draft review might be more than offset by dramatically reducing errors found when the deliverable is complete. For a manufacturing process, you may need to upgrade equipment, send the operators to more training or invest in better raw materials.

9.1.1 Manage Quality / Process / Deliverable Review

Deliverable reviews, or walkthroughs, can be applied to any intangible deliverable produced by the project. For example, the project workplan could go through a deliverable review. Project business requirements can be reviewed. You can walkthrough program code, marketing campaigns and research papers. However, you cannot hold a walkthrough for tangible deliverables such as a new computer, aircraft components, automobiles or clothing. The following process can be used to plan and hold a formal deliverable review.

1. Determine the appropriate **review participants**. Try to include only those people who can meaningfully contribute to the review. The more people involved in a review, the longer the review is likely to take.
2. (Optional) Define **interim completeness and correctness criteria** for the deliverable being reviewed, if it is known that the deliverable is not complete. Multiple reviews may be needed to ensure that large deliverables are being created correctly.
3. If possible, **send out the review material prior to the meeting**. There are situations where this is not feasible, but where possible, prior review of the materials can make the review proceed more quickly.
4. **Conduct the review**. The person(s) who created the deliverable walks through the work in a logical order, answering questions as they arise from the participants. Keep the following principles in mind:
 - Try and hold the review to one hour or less. If the product is too big to be reviewed in an hour, consider breaking it down into smaller parts that can be reviewed in an hour.
 - During the review, the participants should raise questions, voice concerns and offer suggestions. If any topics become complicated, they do not need to be resolved at the walkthrough. They should be taken offline. Likewise, no consensus needs to be reached. If necessary, a consensus or confirmation can occur outside of the meeting.
 - Don't make review comments personal. The review is of the product, not the person who developed the product.
 - If there are issues with the developer or the development process, they should be taken up in a separate meeting.
 - Keep a list of action items during the review.
5. **Conclude the review**. Determine how the product fared by using one of the following ratings:
 - Pass - the product meets all the completion criteria set forth in the review and does not need further review. Some small changes can be requested, but they do not have to be reviewed again.
 - More work needed - the product needs rework to meet the completion criteria required for the review. Document any action items that came out of the meeting and move them to the **Project**

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Workplan. When a product fails review, it will typically need to be reviewed again with the same completion criteria, once the necessary changes have been made.

6. **Communicate** the results of the review. Make sure that all interested parties are given the results of the review.

9.2 Manage Quality / Techniques

The Characteristics of Quality

It is hard to get a grip on quality because it is nebulous and means different things to different people. However, the characteristics of quality can be broken out so that they are more concrete for a project or a deliverable. There are two types of quality for a project. The quality of the physical deliverables produced and the quality of the service provided. The following table shows some of the breakdown of project and service quality.

Product Quality / Product is:	Service Quality / People are:
Reliable Easy of use Easy to maintain when completed Available when needed Flexible for future needs Good value for dollars spent Intuitive / easy to understand Secure Well documented Minimally defective (Doesn't have to be perfect) Responsive (Good response time.) A match to customer needs	Responsive Competent Accessible Courteous Good communicators Credible Knowledgeable of the customer Reliable

The Costs and Benefits of Quality

One of the basic tenets of quality management is that the overall benefits of building a quality solution will more than outweigh any incremental costs. For an explanation of the cost of quality, the benefit of quality and the cost of poor quality, see 9.2.1 Cost and Benefits of Quality.

Gold plating - Delivering More Requirements than the Customer Requested

If possible, you should always strive to carefully set expectations and then meet those expectations. However, if you are not confident in your ability to deliver, you may also have heard it is better to under promise, but over deliver. This is actually a good thing if it refers to your ability to deliver your work earlier than promised, or for less money than your estimate. However, it is not the right thing to do in terms of business requirements.

Even though it might seem that this is a good thing, it actually is not. The term gold plating refers to delivering more requirements than what the customer requested. It is wrong for two reasons. First, the primary focus of the project should be to make sure that you deliver what the customer wants - on time and within budget. By adding in additional work, the risk increases that the project will not meet its deadline. If you end up missing your deadline date, it will not be good enough to explain that the date was missed because of adding work that the customer did not ask for.

Second, you are taking it upon yourself to make a business decision on what is of most value to the customer. There may be some good reasons why the additional features were not included in the initial project scope. They may, in fact, have had marginal value to the customer. There may be more value in having the solution implemented two weeks earlier. The point is that this is a customer decision and not one that the project manager should make.

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If you under promise and over deliver, this should only apply to delivering earlier or for less money than was anticipated. It should not include delivering more requirements than were asked for. If you can deliver earlier or for less money, let the customer make the decision on what to do with the good fortune.

Focus on Processes, Not People

The focus of the quality management process is to build the right processes so that the entire team can produce high quality deliverables. Therefore, if a particular deliverable has a quality problem, the Project Manager and project team should focus on how the deliverable building process can be improved, not on trying to determine who is to blame. Most problems with quality are the result of processes put into place by management, not because of the malicious act of a particular person.

Quality is Everyone's Responsibility

Some projects have specific roles for a quality assurance person, or a testing expert. By default, the Project Manager has overall responsibility. However, in either case, project quality is not the responsibility of one or two people. It is everyone's responsibility. All of the team, including the customer, has a stake in ensuring that the deliverables produced are of high quality. Everyone is also responsible for surfacing ideas for improvement to the processes used to create the deliverables.

Quality is a Mindset, Not an Event

On some projects, quality is seen as a particular step in the process, or perhaps a series of activities at the end of the process. However, to be effective, people need to adopt a quality mindset. The team members need to take ownership of the deliverables that they produce and ensure that they are of the highest quality when they are first created. They also must not get defensive when others review their work, but realize that a quality process is in place to make sure that the entire project produces quality deliverables, with a minimal amount of errors and rework. The Project Manager should include quality control activities in the workplan, but also stress to the team that quality is a mindset. It should be built into the way the deliverables are produced.

Quality Control Techniques

Quality control activities are those that are focused on the overall quality of the deliverable being produced. Depending on the type of project, the following activities are examples of quality control.

- Deliverable walk-throughs
- Checklists to ensure that deliverables are consistent and contain all the necessary information
- Peer reviews / technical reviews / code reviews
- Reuse of proven software
- Thorough testing (unit, system, integration, acceptance)
- Standards to ensure consistency
- Structured methods to ensure standard, proven processes are used

Quality Control - Testing

Testing is probably the aspect of quality control that is most used today. Even though there are many techniques that build in quality further up-front, the confidence you have as to the overall quality most likely comes from your testing. For this reason, you cannot overlook testing. Testing is your last firewall that ensures that the solution you deliver is of the highest quality possible. Many people think of testing in terms of making sure that the solution satisfies the requirements and that the solution is free from defects. However, think of testing also in terms of proving overall reliability, making sure the solution will work in the exact environment that it will encounter in production, that the solution will not fail over time, that the results produced are consistent and reliable, and that the end results that are created by the solution will not degrade over time.

Quality Assurance Activities

Since quality assurance is associated with the processes used to create the deliverables, the most effective activity is a formal quality assurance review or audit. In the review a third party asks questions about the processes used to create the deliverables to ensure they are adequate. The deliverable itself does not need to be reviewed during the quality assurance review at all. The other aspect of a quality audit is to review the processes that the project team established for itself, to see whether the processes are actually being followed. For instance, if the team had a formal process for managing issues and scope change, an audit would look at project issues and scope changes to see if the processes were, in fact, followed.

Another quality assurance activity is some type of checklist that ensures that a standard deliverable process was followed. For instance, a checklist could include deliverable completion dates, deliverable review dates, validation that all action items were completed, customer approval dates, etc. Because the checklist focuses on a process and not the actual deliverable, it is an example of quality assurance.

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Word About Rework

Strictly speaking, if you have a rigorous quality process in place, there should be no reason for a discussion of rework. In fact, rework is the result of not having rigorous enough quality processes in place to begin with. But, let's be practical as well. No project can afford to spend the time and effort that would be required to guarantee that every deliverable is perfect the first time. Even a company operating at a 'Six Sigma' has some small probability of error. So, let's assume that you have a sound quality plan in place. You still have to deal with rework. Also, with some project methodologies that focus on getting deliverable created regardless of initial quality, rework may be built into the nature of the project. There are a few things to keep in mind about rework.

- Although you may accept rework as part of the nature of the project, it does not mean the project manager and project team should not strive to eliminate it. By continually improving the processes, your goal should always be to eliminate defects and rework.
- If there is to be rework, focus on finding it as early in the lifecycle as possible. Remember that errors in the analysis will propagate into errors in design and errors in construction. If you don't find the errors until testing there will be rework required throughout the life cycle. On the other hand, if you take the time to check for errors in the business requirements, there is less of a chance of propagating analysis errors downstream in the project.
- If you find that you have major rework, consider dedicating resources to the rework activities. Typically, while some portion of the solution is being reworked, other work is still progressing. The longer the rework takes to be completed, the more opportunity there is that this situation will cause other errors as well. So, once you discover the need for rework, try to get it completed as soon as possible.
- Rework is not the same as a scope change. Rework is caused by problems in the quality management process. Rework is needed to bring a deliverable up to the level of quality it should have been at to begin with. Scope change refers to modifying part of the solution because of a new requirement. The effort and cost associated with rework need to be absorbed by the project. Effort and cost associated with scope changes should be agreed to and paid by the customer.

Quality Analysis Techniques

If you collect metrics on your processes and your deliverables, you may find that you are not meeting your quality commitments in terms of defects. There are a number of techniques that can be applied to determine what the quality problems are causes are, and which causes have the highest priority to resolve. These are actually the same techniques that can be applied to any problem-solving scenario. Three popular techniques are described as part of the SPS Project Management Methodology - Manage Issues / Techniques section. They are cause and effect analysis, root cause analysis and Pareto analysis.

9.2.1 The Cost and Benefit of Quality

The Cost of Quality

It was stated earlier that there is a cost to quality. Building quality steps in the workplan add a certain amount of effort and cost to the project. However, these incremental costs will be rewarded with increased benefit throughout the life cycle of the solution. Examples of the cost of quality include:

- **Deliverable reviews.** The time of the reviews for all participants, and the resulting follow-up work from the review.
- **Creation of the Quality Plan.** The time required to plan quality into the project and the solution, including identifying completeness and correctness criteria.
- **Customer approval.** The time and effort required validating that the customer has reviewed interim and final deliverables and has formally approved them as being correct and complete.
- **Testing.** Testing is a part of the development life cycle, but it is also used to ensure the solution meets requirements and quality standards.
- **Quality control standards.** Relevant standards utilized throughout the project and/or the organization

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- **Quality Control and Quality Assurance Groups** - If your company has distinct groups that specialize in quality control or quality assurance, their costs are part of the overall costs of quality for the organization.
- **Metrics gathering.** Metrics are normally gathered to show the status of a process and to correct or improve the process if necessary.

The Benefits of Quality

The costs of quality must be weighed against the benefits of providing a quality solution. Whereas many of the costs of quality show up in the project, many of the benefits of quality show up over the entire life cycle of the solution. The benefits of quality include:

- **Increased customer satisfaction.** Fewer defects mean that the customer will be more satisfied. Higher service quality will also make the customer experience much more pleasant. This will result in goodwill and may translate into additional sales, or higher margins on future products.
- **Higher productivity.** Fixing errors and reworking previously completed deliverables is a drain on productivity. In fact, they contribute to negative productivity. If the deliverables are produced with less effort the first time, the overall project productivity will go up.
- **Lower costs / shorter duration.** Although there is an initial higher cost to a quality process, this is more than made up with less rework toward the end of the project.
- **Higher project team morale.** Team morale suffers at the end of a project if there is many project errors uncovered in the testing process. If the testing goes smoothly because of the deliverables being right the first time, team morale will rise accordingly.
- **Fewer errors / defects.** Higher quality shows up over the life of the solution with fewer defects and errors. If you are producing a product, higher quality means fewer returns, less warranty work, fewer repairs, etc.

The Cost of Poor Quality

It costs money and time to build a quality solution. You may think that it is cheaper to leave the quality steps out, but this is usually not the case. It is important to recognize that there is also a cost to having poor quality. These costs may not be apparent when the project is progressing, but should definitely be taken into account as part of the full life cycle cost of the solution being delivered. The following list represents examples of the price that is paid in many cases for poor quality.

- **Warranty work.** This includes work that is performed on a product or application for free under a warranty.
- **Repairs / maintenance.** This is work that is done to fix problems after the solution goes live.
- **Customer dissatisfaction.** If a solution is of poor quality, the customer will not be happy and may not buy from you again at a later date.
- **Help desk.** Maintaining a help desk service may be required, because the customer has problems with the solution, or has questions understanding how to utilize the solution.
- **Support staff.** A support staff is needed to maintain and support a solution because of problems, errors, questions, etc.
- **Poor morale.** No one likes to work for an organization that has poor processes or produces poor quality solutions. Costs here include increased absenteeism, higher turnover and less productivity from the staff.

9.3 Manage Quality / Deliverables

Size	Information Needed
	Deliverable: Quality Plan
Medium	Major deliverables: List the major project deliverables. These deliverables should be identified in the Project Definition , and just need to be validated.
Large	Completeness and correctness criteria: In many cases, the Project Manager and the customer agree on the major deliverables, but then disagree on what is contained within the deliverable, and when the deliverable is completed. The completeness and correctness criteria provide more detail about the deliverable so that there will be common expectations on when the deliverable is complete. The more succinctly you can define the criteria, the more likely you are to have successful deliverables that pass the quality review

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Quality control activities: For each of the deliverables identified, describe the quality control activities to ensure they will be of high quality. You could note that you will be completing a Quality Control Checklist for each deliverable, or for each development phase. An example is shown in 9.3.1 Manage Quality / Quality Control.

Quality assurance activities: Describe the activities that will be performed to ensure that effective processes are being used to create the deliverables on the project. You could note that you will be meeting with your client sponsor or with your manager to compile a Quality Assurance Checklist for each deliverable, or for each development phase. An example is shown in 9.3.2 Manage Quality / Quality Assurance.

9.3.1 Manage Quality / Quality Control

Quality control activities are those that are focused on the overall quality of the deliverable being produced. Quality control is usually the responsibility of the Project Manager, and the specific person responsible for a deliverable. The following list represents the type of questions that can be asked for specific major deliverables your project may be creating. Similar questions can be asked of all deliverables on your project. Because quality control is applied to individual deliverables, it makes sense to apply the checklist on a deliverable-by-deliverable basis.

Deliverable	Quality Control Questions
Project Definition	<ul style="list-style-type: none"> Was the standard template utilized for the Project Definition? Are the project objectives specific, realistic and within the control of the project team? Are the project deliverables clearly defined? Does the scope clearly state what is in and out of scope? Does the overall defined project approach make sense? Does it seem likely the project will be successful if executed as defined in the approach section? Are the overall cost, effort and duration clear? Is the project organization clear? Has a Project Sponsor been identified? Have all major assumptions and risks been identified? Are there risk plans in place for all high and medium level risks? Are the right people identified for project approval? Has the Project Definition been approved by the appropriate people?
Project Workplan	<ul style="list-style-type: none"> Does the workplan support the overall project approach from the Project Definition? Are the risk plans, communication plans, quality control and quality assurance plans been included in the overall workplan? Has the critical path been identified? Does the workplan reflect a breakdown of the work into phases/stages, each with a checkpoint at the end before proceeding?
Business Requirements	<ul style="list-style-type: none"> Was the standard template utilized for Business Requirements? Were the business requirements stated from a user's perspective? Has the appropriate business and process modeling been completed? Have the Business Requirements been approved by the appropriate people?
Conceptual System Design	<ul style="list-style-type: none"> Was the standard template utilized for Conceptual Systems Design? Have the interfaces been identified and defined? Have screens and forms been identified at a high level? Does the overall online and batch process flow well from start to finish? Have the databases been identified and defined? Has the Conceptual System Design been approved by the appropriate people?

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Technical System Design	<ul style="list-style-type: none"> • Was the standard template utilized for Technical Systems Design? • Does the technical architecture comply with all current standards, or have exceptions been granted? • Does the design follow all appropriate development standards and guidelines? • Are the screens, reports, components, databases, etc. been defined in sufficient detail that the construction process can begin? • Has the Technical System Design been approved by the appropriate people?
Construct	<ul style="list-style-type: none"> • Have code reviews been conducted for all new modules? • Has the code been documented well for future understanding? • Have all the software components been successfully unit tested?
Testing Plan	<ul style="list-style-type: none"> • Was the standard template utilized for the Testing Plan? • Were tests conducted to ensure the software works as designed? • Were tests conducted with a variety of invalid and unexpected data to ensure the software responds as expected? • Has the solution gone through integration testing, system testing and user acceptance testing? • Have the business customers formally approved the results of the testing process, signifying the solution is ready to move to production status?

9.3.2 Manage Quality / Quality Assurance

Quality assurance refers to validating the processes used to create deliverables. It is an especially helpful tool for managers and sponsors. They may not have the time or expertise required to validate whether deliverables are complete, correct and of high quality. However, they can discuss the processes used to create the deliverables to determine if they seem sound and reasonable.

In addition to looking at current processes, one of the basic premises behind a quality assurance review is to look for things that could go wrong. For instance, you may ask how a document was created and approved, and you may receive a valid answer. However, the reviewer needs to also be able to determine if the process is as thorough as it needs to be. The discussion can include ideas about what things could go wrong and what the likelihood is of that occurring. If something did go wrong with the process, discuss what the project impact could be.

This is where perspective and flexibility come into place. You do not want to spend the time and effort associated with trying to make perfect processes. You will find that the 80/20 rule works just fine. There is going to be some chance that something could go wrong with any project process. However, the impact of a problem is normally not enough to require additional and redundant processes. If the consequences were dire, then you would want a tighter and redundant process. However, if the consequences are not significant, then an 80/20 process will be just fine.

The following questions can be used to guide the quality assurance discussion, depending on the specific phase the project is in.

When	Quality Assurance Discussion
Up-front project definition	<ul style="list-style-type: none"> • Has the right sponsor been identified, and have they formally approved the project? • Has a Project Definition been written and approved by the appropriate managers and sponsor? • Did the key stakeholders participate in the planning? • Are the resource requirements adequate? • Has a valid project workplan been created?

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	<ul style="list-style-type: none"> • Has a sound estimate been created in terms of effort, cost and duration? • What project management procedures will be used to control the project?
Project management questions to be asked at the end of every major phase	<ul style="list-style-type: none"> • Is the Project Manager utilizing the workplan to manage the work performed of the team? • Does the workplan accurately reflect the work remaining? • Can the Project Manager clearly explain where the project is vs. where it should be at this time? • Will all the deliverables specified in the Project Definition be completed? • Are solid processes being used to manage issues, scope and risk? • Should the project definition be updated to reflect any major changes to the project? • Is the Project Manager communicating effectively with status meetings and status reports? • Is the project on track in terms of cost, duration and quality? • Are the business customers happy with the project progress so far? • Are customer expectations being properly managed?
At the end of the gathering business requirements	<ul style="list-style-type: none"> • Have the business clients reviewed and approved the requirements? • What other deliverables did the project produce during this phase? Did the appropriate business clients approve them? Examples include: <ul style="list-style-type: none"> ○ Conceptual System Design ○ Testing Strategy ○ Data Conversion Strategy ○ Training Strategy • Is the project following appropriate company standards, guidelines and policies?
At the end of the design, construct and testing phases	<ul style="list-style-type: none"> • What deliverables did the project produce during each phase? Did the appropriate business clients approve them? Examples include: <ul style="list-style-type: none"> ○ Technical Design ○ Testing Plan ○ Training Plan ○ Data Conversion Plan ○ Tested solution • If the preceding deliverables are not created, discuss how the testing was accomplished, how the training will be performed and how data will be converted. • Is the project following appropriate company standards, guidelines and policies? • Is the project following the standard company technology architecture?
After the solution was implemented	<ul style="list-style-type: none"> • Was the solution formally approved and accepted by the Project Sponsor before being moved to production status? • Is the project team initially supporting the production solution? • Are initial problems being resolved in a timely manner? • Is the solution being properly transitioned to the support team?

9.4 Manage Quality / Additional Workplan Activities

Size	Information Needed		
Medium	Activity	Effort	Comments

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	Define the Quality Plan	open	This is done during the Define Project Step, as a part of the Project Management Procedures .
	Quality Control Activities	open	Move all the quality control activities for each deliverable to the Project Workplan
	Quality Assurance Activities	open	Move the quality assurance activities for the project to the Project Workplan
Large	Activity	Effort	Comments
	Start with the same activities as a medium project.		
	Gather metrics	open	Gather metrics on a monthly and quarterly basis to describe how the project internal processes are working.
	Analyze metrics for process improvements	1-2	Spend some time each month analyzing the collected metrics to see if the processes can be improved. When processes are changed, continue to collect the metrics to see if the improvements can be proven quantitatively.

10.0 Manage Metrics

Gathering metrics on a project is the most sophisticated project management process, and can be the hardest. Because metrics can be hard to define and collect, they are usually ignored. All projects should be gathering basic metrics information regarding cost, effort and cycle time. Step 10.0, however, refers collecting metrics to determine how well the deliverables satisfy the customer's expectations, and how well the internal project delivery processes are working. Depending on the results, corrective action or process improvement activities can be undertaken to make the processes more efficient and effective.

Managing metrics and managing quality are related. It is very difficult to improve the quality of your deliverables or your processes if you are not gathering metrics. Metrics are used to give some indication of what the beginning state of quality is, and whether quality is increasing or decreasing. At the same time, you have to ask yourself what you will do with metric information when you gather it. If you do not intend to leverage the metrics to help manage the project, in particular to help manage quality, then there may not be a reason to gather anything other than basic cost, effort and duration information.

At a high level, it is also worth noting that metrics management can be used effectively on medium/large projects because there is enough time to capture the data, analyze the results and make appropriate changes. The most value is gained, however, if the metrics are used to drive improvements on an organization wide basis. Because each project is unique, the accumulation of consistent metrics from all projects can be used to drive process improvements across the organization. Ultimately the information can be used to create a set of best practices and standards that will help all projects. By implication then, gathering sophisticated metrics on small/medium projects will have limited value if they are not leveraged at a higher organization level.

10.1 Manage Metrics / Process

10.2 Manage Metrics / Techniques

10.3 Manage Metrics / Deliverables

10.4 Manage Metrics / Additional 'Build Workplan' Activities

10.1 Manage Metrics / Process

Small Projects

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For the most part, small projects should concern themselves with capturing metrics that are required across the entire organization. These usually consist of basic information as to how the project is actually progressing in terms of cost, effort and duration. These numbers can be compared against the original estimates to help determine how well the project performed. Any other metrics that are required for all projects should be captured and reported as well.

There is usually not a need to capture more sophisticated metrics on the project deliverables or the internal project work processes, since there is not enough time to make improvements or take any actions based on the results of the metrics.

Medium Projects

Medium projects should collect any information that is required across the organization - the same as small projects. Depending on the organization, there may be more information required for projects of this size. The Project Manager should also review the process for defining metrics that is described for large projects. As a medium project gets closer to the size of a large project, there is more and more value associated with formally collecting and leveraging metrics. They may not get as sophisticated as those on a larger project, but there may be additional metric information that would be of value.

Remember that the bottom line on metrics is that you don't want to collect them just for the sake of collecting them. If they are required by your organization, then collect them. Other metrics may be needed to validate whether the project was successful or not. However, if you don't have a purpose for the metrics, or if the project is not long enough that you can use the information for process improvement, then they are not worth collecting for that particular project.

Large Projects

This size project should definitely be capturing metrics that will provide information on the quality of the project and the processes used to create the deliverables. The following process can be used to come up with the appropriate metrics on the project. This process will result in the creation of a Project Scorecard.

1. **Identify criteria for success.** Review the objectives and deliverables in the **Project Definition**, as well as any other existing information that is relevant to the project. Based on this existing documentation, define what information is needed to show that the project was successful. This can be from two perspectives:
 - Internal – These characteristics indicate that the project was managed and executed effectively and efficiently. This might include completing the project within approved budget and timeline, deliverable approval with no more than two review iterations, hitting major internal milestone dates on time and having a minimum amount of errors uncovered in user acceptance testing.
 - External – These characteristics indicate that your project objectives were completed successfully. Examples include creating all the major deliverables defined in the Project Definition, ensuring your deliverables meet approved quality criteria and customer surveys that show the level of satisfaction with the deliverables produced.
2. **Assign potential metrics.** Identify potential metrics for each of the success criteria that provide an indication whether or not that success criteria are being achieved. These can be direct, quantifiable metrics, or indirect metrics that give a sense for success criteria. For each metric, briefly determine how you would collect the information, what the effort and cost of collection would be, and what value would be obtained.
3. **Look for a balance.** The potential list of metrics should be placed into categories to make sure that they provide a balanced view of the project. For instance, you do not want to end up with only a set of financial metrics, even though they might be easiest to obtain. In general, look for metrics that provide information in the areas such as:
 - Cost
 - Effort
 - Duration
 - Productivity
 - Quality of deliverables
 - Customer satisfaction with the deliverables produced
 - Project team performance

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- Business value delivered

A table of sample metrics can be viewed at 10.1.1 Sample Metrics

4. **Prioritize the balanced list of metrics:** Depending on how many metrics you have identified, prioritize the list to include only those that have the least cost to collect and provide the most value to the project. There can certainly be as many metrics collected as make sense for the project, but there may end up being no more than one or two per category. In general, look to provide the most information with the least amount of work.
5. **Set targets:** The raw metric may be of some interest, but the measure of success comes from comparing your actuals against a predefined target. The target may be a single value you are trying to achieve, or it may be a range. For instance, you may need to complete your project by a certain fixed date, but your actual cost might need to be +/- 10% of approved budget.
6. **Add workplan detail:** For each metric that remains, determine the specific information necessary to add the appropriate activities to the project workplan. This will include:
 - What specific data is needed for the metrics?
 - Who is responsible for collecting the metric?
 - When will the metric be collected and reported?
 - How will the metrics be reported (status reports, quarterly meetings, metrics reports)?

10.1.1 Manage Metrics / Process / Sample Metrics

The following list provides ideas on the types of metrics that could be reported. This list is not exhaustive by any means, but may help provide additional ideas for your project.

Business Category	Metrics
Cost	<ul style="list-style-type: none">• Actual cost Vs budget (variance) for project, for phase, for activity, etc.• Total support costs for x months after solution is completed• Total labor costs Vs non labor (Vs budget)• Total cost of employees Vs contract Vs consultant (Vs budget)• Cost associated with building components for reuse• Total cost per transaction• Ideas for cost reductions implemented, and cost savings realized
Effort	<ul style="list-style-type: none">• Actual effort Vs budget (variance)• Amount of Project Manager time Vs overall effort hours
Duration	<ul style="list-style-type: none">• Actual duration Vs budget (variance)
Productivity Difficult to measure accurately unless function points are counted.	<ul style="list-style-type: none">• Effort hours per unit of work/function point• Work units/function points produced per effort hour• Effort hours reduced from standard project processes• Effort hours saved through reuse of previous deliverables, models, components, etc.• Number of process improvement ideas implemented• Number of hours/dollars saved from process improvements

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Quality of Deliverables	<ul style="list-style-type: none"> • Percentage of deliverables going through quality reviews • Percentage of deliverable reviews resulting in acceptance the first time • Number of defects discovered after initial acceptance • Percentage of deliverables that comply 100% with organization standards • Percentage of deliverables that comply with organization architectural standards • Number of customer change requests to revise scope • Number of hours of rework to previously completed deliverables • Number of best practices identified and applied on the project • Number of risks that were successfully mitigated
Customer Satisfaction with Deliverables*	<ul style="list-style-type: none"> • Overall customer satisfaction with deliverables in terms of: (survey) <ul style="list-style-type: none"> ○ Reliability ○ Minimal defects ○ Usability ○ Response time ○ Ease of use ○ Availability ○ Flexibility ○ Intuitiveness ○ Security ○ Meets customer needs ○ Easy to understand messages ○ User documentation • Application response time (calculated by the system) • Number of approved business requirements satisfied by the project
Customer Satisfaction with Project Team*	<ul style="list-style-type: none"> • Overall customer satisfaction with the project team in terms of: (survey) <ul style="list-style-type: none"> ○ Responsiveness ○ Competence ○ Accessible ○ Courteous ○ Good communication ○ Credible ○ Knowledge of the customer ○ Reliable / follows through on commitments ○ Professionalism ○ Training provided ○ Overall customer satisfaction • Turnaround time required to respond to customer queries and problems • Average time required to resolve issues • Number of scope change requests satisfied within original project budget and duration

10.2 Manage Metrics / Techniques

Why Do We Measure?

Identifying, gathering and leveraging the right mix of metrics adds value to a project, especially if they are also analyzed across the entire organization. The value can be quantified in a number of areas including:

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- Improved performance of the overall project fulfillment and delivery process
- Improved estimating for future projects
- Identification of quantifiable duration, cost, effort and quality objectives for the project
- Identification and communication of best practices
- Improved customer satisfaction

In general, metrics provide a more factual and quantitative basis for how you are doing and what can be done better. Without at least some basic metric information, all discussions on performance and improvement are based on anecdotal evidence, perceptions and guesses. If you want your project's success or failure to be based on factual information, you need to determine ahead of time what the success criteria are and how to measure them. Then collect the metrics, even if they are imperfect and imprecise. They still provide a better foundation than recollections, perceptions and guesses.

The Cost of Metrics

Just as there is some cost associated with most project management activities, there is a cost to collecting and managing a metrics process. In the case of scope management or issues management, this is a cost the project needs to invest in to be successful. Managing metrics, however, is more under the discretion of the Project Manager and the overall organizational culture. In many cases, the cost to collect and leverage a certain type of metric is prohibitive. These metrics should not be pursued. Other metrics are interesting, but do not provide the type of information that can be leveraged for improvement. The bottom line is that the cost to gather each metric must be balanced against the potential benefit that will be gained. Start by gathering metrics that are required by the organization. Then add metrics that have the lowest cost and effort and can provide the highest potential benefit.

Link Team Performance with Individual Performance

This old adage about what gets measured gets done, is true on projects. If communication is important on your project, then build some metrics around communication. For instance, survey the customers and a stakeholder on a quarterly basis to see how effective they think your communication is. If you are encouraging your team to reuse existing components is important, then track the instances of reuse and the hours and cost savings.

However, if the results of the metrics do not have a corresponding personal impact on the team members, you still may not drive the behaviors you need. The key is to collect metrics that give a quantifiable indication of overall team performance, and then make sure that there is a connection between team performance and individual performance. An example of where these are not linked is the classic case of the project that is seen as a failure, yet all the team members are evaluated highly on their performance reviews. Make sure that team metrics are reflected appropriately in the individual performance reviews. If the team was successful, then team members should be rewarded. If the team was not successful, then team member reviews should be impacted accordingly.

Manage Metrics - Beware Unintended Consequences

Measuring things will tend to drive certain behaviors. Therefore it is critical that the metrics you collect not drive unintended behaviors. As an example, a business team was being measured on the length of time it took to close customer problem tickets related to billing and invoices. Over time they developed an informal rule. If the ticket was open for two days, the team members guessed at problem and then closed the ticket. If the guess did not solve the problem, a new ticket was opened. The result was repetitive thrashing of problem tickets, wasting much more project time than required. In this case, one of the problems was the metric. This team looked good on paper, but in reality they were performing poorly, generating extra work and causing the customer satisfaction problems. Perhaps a better metric would have been to keep the ticket open until the customer agreed that the problem was resolved. When you are setting up the logistics for the metrics, including how it will be reported, think about how the metric might drive unintended consequences, and be sure that you set up the process in a way that clearly drives the desired behaviors.

Gather a Baseline if no Target is Available

The collection of metrics information by itself provides only limited value to the project. Most of the value comes when you can compare your metrics against some type of standard or target. For many metrics, there is an implicit target, even if you don't always specifically state it. For instance, the collection of actual effort, duration and cost information is used to compare against the estimated effort, duration and cost to see how the project stands.

For many metrics, however, there is not necessarily an implicit target to attain. For instance, if you track your customer's satisfaction with the project, they may rate your team an average of 3.8 out of a 5.0 scale. However, is that a good number or a

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bad number? Since you have nothing to compare it with, it's hard to say. The way to gain more value from the metric is to use the first measurement as a baseline - that is, a reflection of where you are at today. In the survey example, what you would want to do is improve upon your baseline numbers. For instance, after collecting a baseline of 3.8 out of 5.0, you may choose a target of achieving a 4.2 out of 5.0 before the project is over. Another option is to look for a 10% improvement in the baseline, once the original metrics have been collected.

To summarize, gathering metrics by themselves don't tell the whole story. The metrics need to be compared to a target to determine if you are being successful or not. If the target value exists, such as the estimated budget, then you have the comparison you need. However, if the target doesn't exist, then you must capture the current state metrics as a baseline. Then compare subsequent metrics against the baseline to see if you are improving or not. Keep in mind that the baseline metric may not be easy to achieve. In some cases, you may want to accumulate a number of initial metrics before declaring your baseline. For instance, you may want to track defects on a system for three months, and then take the average number per month as the overall baseline.

Measuring Business Value

One of the holy grails of metrics is to be able to accurately capture the business value produced by a project. In some cases the value is obvious. Sales could increase. Inventory levels can be reduced. Less people may be needed in a process. However, in many cases, this can be difficult or impossible to quantify exactly. Some common problems include:

- The project produces incremental improvements that are hard to quantify exactly.
- The project produces soft benefits, such as improving customer satisfaction or product quality.
- The project involves infrastructure, which is used by large groups of people. For instance, how much more productive will people be if we double the memory in their desktop computers? What is the quantifiable value provided with a new internal phone system?
- The project results in an increase in the amount of information people have available. It's hard to know exactly how the information gets leveraged to produce better decisions.
- Things improve as a result of multiple projects over a period of time, but it is hard to know exactly how much value each project delivered.
- The results are improvements at a low level that are hard to meaningfully roll-up. For instance, eliminating steps in a process. That process takes less time, but other work takes up the time.

The bottom line is that a value proposition or cost/benefit analysis is usually done before a project begins. Look at how the benefits were quantified in this document to see if you can measure similar results when the project completes. If there are hard benefits identified, then the metrics should be able to show how much value was delivered. If there were soft benefits identified, then you will probably need to stick with anecdotal and indirect evidence of the value provided.

Gathering Metrics with Customer Satisfaction Surveys

Gathering metrics is important because it allows you to see how you are performing against the expectations of your customers. If the world were perfect, all of the metrics you collect would be factual, relevant and accurate. However, in many cases it is impractical or cost-prohibitive to try to gather exact and quantitative numbers. One way to supplement any quantifiable metrics is with customer satisfaction surveys. For instance, instead of trying to measure the exact response time of an application against some service-level standard, you could simply ask your main users how satisfied they were with the application response time. In the same way you may want to gather metrics about the time it takes to resolve problems once a customer notifies you of a problem. This could involve tracking when the initial request comes in, when you first responded to them and when the request was resolved. On the other hand, you could simply send out surveys that ask your customer if they were satisfied with the time it took to resolve the problem.

Surveys are by their nature qualitative; that is, they reflect the opinion of the person being surveyed. Therefore, you would not necessarily want to base your entire success criteria on survey metrics. Some results are more easily obtained quantitatively. For instance, there is usually no reason to send out a survey to the finance department to ask them if your spending is within budget. You should have the facts available to you. However, for many other types of metrics, a qualitative survey question can be asked as a substitute for the quantitative metric.

Gathering Past Metrics Can Assist on Future Projects

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Gathering a consistent set of metrics at the end of a project can help your organization see the trends for delivering projects over a period of time. The metrics should show how well project teams are meeting their commitments in terms of quality, cost and cycle-time. As more and more projects report the metrics, a baseline will be established that you will be able to compare yourself to over time.

If these project demographics (characteristics) and metrics are placed in a file or database, they can be analyzed to show the overall trends. For instance, you can compare actual cost to deliver versus the estimated cost, and then track the trends over time. The advantage of gathering some project demographics is that you can compare similar projects. For instance, you can see compare customer satisfaction levels with mainframe development projects versus web development projects.

The other benefit of gathering project demographics is that you can use the information for future project estimates. For instance, if you have a new web development project, using ASP and SQL*Server, for the entire company, you can query the prior metrics to get a sense for how much time, effort and cost were involved. This may be of help for estimating your project. In general, whatever demographics you capture from completed projects can be used to search on later for new projects

10.3 Manage Metrics / Deliverables

Size	Information Needed
Small	<p>The only metrics that may be required for small projects are cost, effort hours and deadline numbers that may be required for all projects in your organization. These can be reported in the project Status Report. Your target value (for instance the budget) should be reported as well. Add appropriate comments to explain the results, resulting actions, etc.</p> <p>The metric information can be represented as numbers, tables, graphs, charts etc. Bar charts are especially effective in showing the overall trend for a metric by graphing prior actual values as well.</p>
Medium	<p>Medium projects should first fulfill the metrics requirements for small projects (above).</p> <p>In addition, the Project Manager should look at the Project Scorecard deliverable for large projects. The larger the project, the more value there will be in creating an internal Project Scorecard.</p>
Large	<p style="text-align: center;">Deliverable: Project Scorecard</p> <p>The Project Scorecard should contain the details associated with collecting and reporting metrics, including:</p> <ul style="list-style-type: none"> • The actual metric you are collecting. • The target for the metric, and the scale, if appropriate. For instance, your target may be 92, on a 100-point scale. • Describe the data that is needed to derive the metric. • Define who is responsible for collecting the data, and how often. • Describe the process used to capture the metric.

10.4 Manage Metrics / Additional Workplan Activities

Size	Information Needed		
Small	Activity	Effort	Comments
	Collect and report metrics	1 hour / week	Collect and report the metrics per the procedures defined above. Because small projects tend to have short duration, you may have to collect and report the information weekly. Some metrics might only be reported at the end of the project.
Medium Large	Activity	Effort	Comments
	Define the Project Scorecard	Medium 2 - 4 hours Large 3 - 8 hours	This work can be done as a part of defining the project, or as one of the first activities after the project starts - probably in analysis phase. Follow the process described in Step 10.1. Much of this work can be accomplished in a meeting of key team members and stakeholders.

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	Collect and report metrics	open	Monthly: Collect and report the metrics as described in your Project Scorecard.
	Process improvements activities	open	Monthly: Add time to your workplan to analyze the metrics and what they are telling you. Then you can add activities throughout the project to implement process improvements based on an analysis of the metrics gathered so far.
	Evaluate the Project Scorecard	open	Monthly: Evaluate the metrics you are collecting on a monthly basis to ensure they still accurately reflect the overall project status, and that they are driving the behaviors desired.

11.0 Project Kickoff Meeting

Projects don't always go through an organized sequence of planning, approval and execution. Sometimes a project is in various stages of planning, approval and execution. Before you know it, you can be in the middle of the project with team members and stakeholders having various levels of understanding about what is going on and why. Just as a project should have a formal meeting and approval to signify that it is complete, it also makes sense for a meeting to formally let everyone know that the project has begun.

That purpose of the kickoff meeting is to formally notify all stakeholders that the project has begun, and make sure everyone has an understanding of their roles and responsibilities. The kickoff meeting is a time to get all the team members; customers and stakeholders together and formally set the stage for the start of the project. Like all formal meetings, there should be an agenda, and the meeting should follow good meeting format. There are a number of specific things you want to cover at this meeting.

- Introduce the people at the meeting.
- Recap the information in the Project Definition, including:
 - The purpose of the project
 - Scope
 - Major deliverables
 - Risks
 - Assumptions
 - Estimated effort and budget
 - Deadline
- Discuss the important roles and responsibilities of the project team, customers and stakeholders. Many, if not all of the people will be in attendance. If there is confusion about the role of each person or organization, it should be discussed now.
- Go over the general approach and timeline of the project. This gives people a sense for how the project will unfold. In particular, you will want to ensure that people understand what they need to be doing in the short-term to support the project.
- Discuss and answer any outstanding questions. The purpose of the discussion is not to rehash the purpose of the project, but allows people to voice specific questions or concerns they have as the project begins.
- Confirm that the project is now underway. If it was not before, it should be starting effective immediately.

Other items to consider in the kickoff meeting include:

Attendees. In general, the project team, customer and stakeholders should be in attendance. If this results too many people for comfort, you can consider having the major players there only. You can then meet with others in subsequent mini-kickoff meetings, or you can send the relevant meeting information to the people who could not be there.

Length: Although most kickoff meetings can be conducted in an hour or two, others might require a day or two. The longer kickoff meetings are especially important if the project is very complex or controversial. In some cases, a long kickoff meeting may be useful as a way to gather initial requirements, although that would not be the primary purpose.

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Preparation. It is said you never have a second chance to make a good first impression. This is true with the kickoff meeting. You are using the meeting to help set expectations for the project. If the meeting is unorganized, chaotic or a waste of time, the participants will probably carry those perceptions into the project as well. Make sure that you have prepared well for this meeting and that it goes smoothly. Talk to your sponsor ahead of time, and make sure you are in agreement with how the meeting will go.

The Chinese say that a one thousand mile journey begins with a single step. After the planning process is completed, schedule a kickoff meeting to ensure your project gets off on the right foot.

12.0 Configuration Management

Configuration management is the term given to the identification, tracking and managing of all the assets of a project. (You can also refer to configuration management in terms of an organization, but we are only concerned with projects here.) Some of the project management literature considers configuration management to be one of the standard project management processes. However, I do not think that it belongs at that core level for the following reasons:

- Many (most) projects do not worry about tracking physical assets such as equipment, supplies and raw materials. If these assets need to be tracked, it is done at an organizational level. For instance, tracking and managing personal computers is usually done at a company or division level. The project manager of an individual project may need PCs for the team, but they don't have to track and manage the asset.
- If your project is worried about asset tracking, this is usually done outside of the realm of the Project Manager, and is instead handled by specialists on the team. For instance, if you are building an airplane, the tracking of materials is vital. However, there are team specialists that are assigned to manage this aspect of the project. If you are on a software development project, you need to track your software code. However there are software change management tools that will manage these assets. Again, I don't necessarily think it is a core project management responsibility.
- Documentation is also an asset. In fact, most projects do need to track and manage documents. That aspect of configuration is covered in step 8 of the of the SPS Project Management Process - Manage Documents.

All that being said, even if configuration management is not a core project management function, it is still an important process on many projects. For further explanation, the parts of configuration management include:

1. **Planning** - You need to plan ahead to create the processes, procedures, tools, files and databases you will need to manage the project assets. You also may need to gain an agreement on exactly what assets are important, how you will define them, how they will be categorized, classified, numbered, reported, etc. The results of this up-front planning are documented in a Configuration Management Plan.
2. **Tracking** - You need processes and systems designed to identify when assets are assigned to your project, where they go, what becomes of them, who is responsible for them and how they are disposed. Since a project has a finite beginning and end, ultimately all the assets need to go somewhere. This could be in a final deliverable, into the operations/support area, scrapped, etc. You should be able to dissect each major deliverable of the project and show where all the pieces and parts came from.
3. **Managing** - Managing assets has to do with ensuring they are secure, protected and used for the right purposes. For example, it doesn't do any good to track purchased assets that your project does not need in the first place. Also, your tracking system may show expensive components sitting in an unsecured storage room, but is that really the proper place for them? Managing assets has to do with acquiring what you need, and only what you need. You also need to make sure you have the right assets at the right place at the right time.
4. **Reporting** - You need to be able to report on the project assets, usually in terms of what you have and where they are, as well as financial reporting that can show cost, budget, depreciation, etc.
5. **Auditing** - Periodically, or at major milestones, you need to validate that your configuration management processes are correct and accurate. This usually involves a physical validation that your assets volume is correct and the assets are where you think they are. Many projects get in trouble when they start to lose track of material and supplies. Sometimes they are just misplaced. Other times they may be stolen. However, they were acquired because they were needed by the project. If they are not available, this may cause project cost overruns or delay.

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If you practice configuration management on your project, it is suggested that you have a specific person identified as the Configuration Manager. This may be a part time role, depending on how much asset tracking and management your project does. This person is responsible for the overall process, with focus on the planning, management and auditing responsibilities. If your project is large enough, you can also designate a Configuration Librarian. This is more of an administrative position that focuses on the legwork and follow-up needed for the tracking and reporting responsibilities. Of course, if your project (or program) is big enough, such as building an aircraft, you are probably going to have a whole department doing this work, perhaps under the direction of the Purchasing / Procurement department.

13.0 Procurement / Purchasing / Contracts Administration

In general, procurement refers to the aspects of project management related to obtaining goods and services from outside companies. This specifically refers to vendors and suppliers. It does not refer to other internal organizations within your own company. For the purposes of this discussion, purchasing and procurement are equivalent terms.

In some project management methodologies, procurement is considered one of the primary responsibilities of a project manager. For instance, in the Project Management Body of Knowledge (PMBOK) from the Project Management Institute (PMI), it is considered one of the core nine-project management knowledge areas. Other methodologies, including SPS methodology, do not raise it to that same level. This is an area that Project Managers definitely need to understand at some level, and it is an area that the Project Manager will have input into. However, in many, and perhaps most, companies, procurement is an area that the project manager does not own. For instance, if there is a scope change request, the Project Manager owns that scope change management process, and must ensure scope changes are handled correctly. However, if your project needs computers, or raw materials, or supplies, or contract people, the processes that are used are typically owned by a separate Purchasing or Procurement Department. The Project Manager normally does not have the authority to enter into contracts on behalf of the company, and they normally are not asked to administer the contracts once they are in place. Again, these are processes that the Purchasing Department typically owns.

The PMBOK describes six processes within the Project Procurement Management knowledge areas. These are listed below to provide some explanation of the overall processes that are included in this area.

1. **Procurement Planning** is the process of determining what to purchase and when you need it. This is typically under the control of the Project Manager. The centralized Purchasing Department is not going to know what each particular project team needs.
2. **Solicitation Planning** is the process of creating requirements for all the products and services your project team needs. The project team needs to perform this function. You also need to start identifying potential companies that can supply the products and services. Most projects do not require unique products and services. Typically other projects have used similar products and services before. If they have, then you most likely have a list of companies that already have contracts in place to provide what you need. This is typically the case for contract resources, supplies, computer hardware, etc.
3. If you determine that there are not companies available to supply a product or service you need, you need to go through the **Solicitation** process, where you identify a long-list of vendors to consider, and receive information on their capabilities and price through proposals and quotes. When you are done with the **Solicitation**, you typically narrow down the long-list of potential companies to a short-list of qualified companies. Although the project team may perform much of the work associated with the **Solicitation** process, it is typically a process that is owned by Purchasing. That is, there should be a defined process, or someone from the Purchasing Department that will help guide the **Solicitation** process to ensure that the necessary factors are taken into account, and that viable companies are selected for the next step.
4. **Source Selection** is the process associated with actually choosing the vendor who will provide the product or service. Again, the project team may make the final selection, but Purchasing typically has defined the overall process. In some companies, Purchasing may, in fact, make the final decision based on project team input. Most companies do not want to enter legal contractual relationships based on the expertise of a Project Manager. Normally companies will need Purchasing and perhaps the Legal Department to own the **Source Selection** and contract negotiation processes.
5. **Contract Administration** is the process of managing the relationship with the contracted company. The Project Manager may work on a day-to-day basis with the account manager from the vendor, but they should always work within the contractual relationship. If anything needs to change in the contractual relationship, the Purchasing and Legal Departments are probably the ones responsible for making the contract changes.

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6. **Contract Closeout** occurs if the contractual relationship existed only for the life of the project. For instance, if the contract was in place to provide raw materials for a particular project, then the contract will probably end after the project is over. If you used the vendor to purchase project supplies, then the relationship with the vendor is probably ongoing. If there are contracts that are closed at the end of the project, the Purchasing Department is typically the one that oversees final payments and formally closes the contract. The project team will be involved with the Purchasing Department to make sure all the contracted work was completed, and to gather feedback on how the vendor relationship worked.

14.0 Project Termination

Just as defining the project is considered a project management function, so to is terminating a project. Of course, there are some big differences in focus and importance. A project that is not defined appropriately will not have a good chance to be successful. On the other hand, a successful project that does not conclude gracefully will probably still be seen as successful.

The value of having a planned project termination is in leveraging all of the information and experience gathered throughout the project. If the solution is implemented and the team disbands, you don't have an opportunity to wrap up the loose ends, do staff evaluations, document key learnings or ensure that appropriate deliverables are transitioned to support. Of course, a project can end unsuccessfully as well. Even in this case, there are key learnings, team evaluations and other wrap-up activities to make the most of what was done on the project.

It is the responsibility of the Project Manager to build project termination activities into the project workplan. These should be seen as vital parts of the project, not an afterthought as the team is getting disbanded. The project is not considered completed until the termination activities are performed - just as it would not be complete without the implementation activities being finished.

When the project workplan is created, think about the activities that need to be performed to gracefully and appropriately terminate the project. These activities include:

- **Declaring success or failure:** Sometimes it is obvious the project was completely successful and in other cases the project is a total failure. However, in many cases, there are mixed results. For instance, the major deliverables were produced, but the project was over budget. Or, the project team delivered on time and within budget, but the solution met 80% of the business requirements. The key to declaring success is to define up-front what the success criteria are. If an agreement is reached with the sponsor and the appropriate functional manager on what success means, then the project team can be evaluated against those criteria. The project team should first rate itself against those criteria, and then take the recommendation to the appropriate managers for validation.
- **Hold project conclusion meeting:** A meeting should be held with the project team, sponsor and appropriate stakeholders to formally conclude the project. This meeting will include stepping through a recap of the project, documenting things that went right and things that went wrong, strengths and weaknesses of the project and project management processes, and the remaining steps required to terminate the project. Techniques or processes that worked especially well, or especially poorly, are identified as key learnings of the project. If your organization has a way to publish or leverage these key learnings, they should be sent to the appropriate group. (Key learnings that seem to work consistently on many projects, in many circumstances, might be raised to the level of a best practice, and be utilized for all similar projects.)
- **Transition the solution to support:** If the solution will exist outside of the project, then it should be transitioned to the appropriate support organization. The transition includes knowledge transfer to the support team, completion and turnover of all documentation, turnover of the list of remaining work, etc.
- **Turnover of project files:** A discussion should take place with the support organization to determine what project and project management materials accumulated during the project should be turned over to the support team. Based on this agreement, some of the project material may be deleted or destroyed, some backed-up, some archived, etc. Those files and documents needed by the support organization should be turned over to support for them to store in the appropriate long-term library or folders.
- **Performance reviews:** If the project was substantial or lengthy, it may be appropriate to do performance reviews after the project completes. In this case, their manager and the Project Sponsor evaluate the Project Manager. The

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Project Manager reviews the entire team, or at least the direct reports (and then the direct reports review their direct reports, until everyone is covered). If the team has an overall success rating, this is used as feedback into the individual reviews.

- **Reassignment of the remaining project team:** Any remaining team members should be reassigned when all the termination activities are completed. For some people, this may mean completely new projects. For contract people, it may mean the end of their assignments. For part-timers, it may mean a return to their other full-time role. Some team members may transition into the support organization, working on this same solution.